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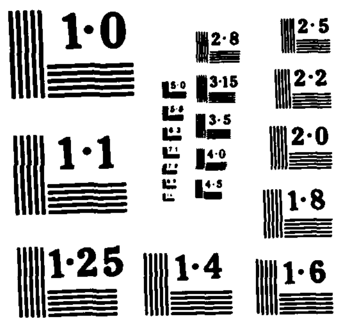

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NRL Report 8929

Analytical Thermal Analysis of the L-Band Transmitter Replacement

T. J. BENNETT

Terrestrial Systems Branch
Space Systems and Technology Division

November 15, 1985

NAVAL RESEARCH LABORATORY
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An L-band transmitter was designed to replace an existing unit. Increased transmitter reliability and increased mean time between failures were of primary concern for the new design. This report details the thermal analysis and design for a transmitter which operates in a sol-air temperature of 110°F (43°C) with zero wind speed. The thermal modeling programs used are Radiation View Factor (RAVFAC) and Systems Improved Numerical Differencing Analyzer (SINDA). The RAVFAC program is supported by a plotting program, Ravplot, and a data reduction program, Colaps.

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ANALYTICAL THERMAL ANALYSIS OF THE L-BAND TRANSMITTER REPLACEMENT

INTRODUCTION

The Terrestrial Systems Branch undertook a task to design an L-band transmitter to replace an existing unit with requirement of improving transmitter reliability by increasing the mean time between failures. A comprehensive, analytical thermal analysis was conducted on the L-band transmitter replacement to identify possible "hot spots." Early detection facilitates the use of proper thermal design to minimize the number and severity of hot spots.

The incorporation of proper thermal design with the electromechanical design will increase electronic component life by decreasing temperature rise. Furthermore, the allowable ambient operating temperature will increase due to improved heat transfer.

The analysis was conducted using several well-established thermal computer programs. Developed by the aerospace industries for the National Aeronautics and Space Administration (NASA), these thermal computer programs have proven successful through many space flight missions.

MECHANICAL DESIGN CONSIDERATIONS AND CONSTRAINTS

Special mechanical design considerations were included to meet the demands of anticipated future systems. Mechanical designs that directly impact the thermal design are detailed below.

To facilitate the replacement of the existing transmitter, the baseplate and mounting holes for the new design match those of the original unit. In addition, the locations of external connectors were maintained whenever possible. The only through holes permitted in the casing of the new design were the connector and pressure fitting holes. This limits the number of possible pressure leaks.

The casing was designed to be purged and pressurized with nitrogen or dry air when a protective radome is not provided. Also, whenever possible, the use and contact of dissimilar metals on and in the casing was avoided to limit electrochemical attack, primarily from rain and salt spray.

The casing walls were constructed of 3/8-in. aluminum plate. This allowed the insertion of number 8 and 10 locking threaded coils without rupturing the walls. The baseplate constructed of half-inch aluminum was the major heat sink of the casing.

The interior of the casing was designed using a modular concept so that each component was a separate entity (Figs. 1 and 2). Each component was attached to a mounting bracket, which in turn was attached to the transmitter casing by way of 10-32 threaded captive screws held to the mounting bracket by captive fasteners. Each modular unit was totally accessible to maintenance personnel for removal.

The mounting brackets are fabricated from quarter-inch aluminum plate, except for the power supplies which require half-inch plate for additional heat sinking. Quarter-inch plate was needed to bottom mount several components to mounting brackets with flathead screws. A thinner plate prohibits proper countersinking of mounting holes.

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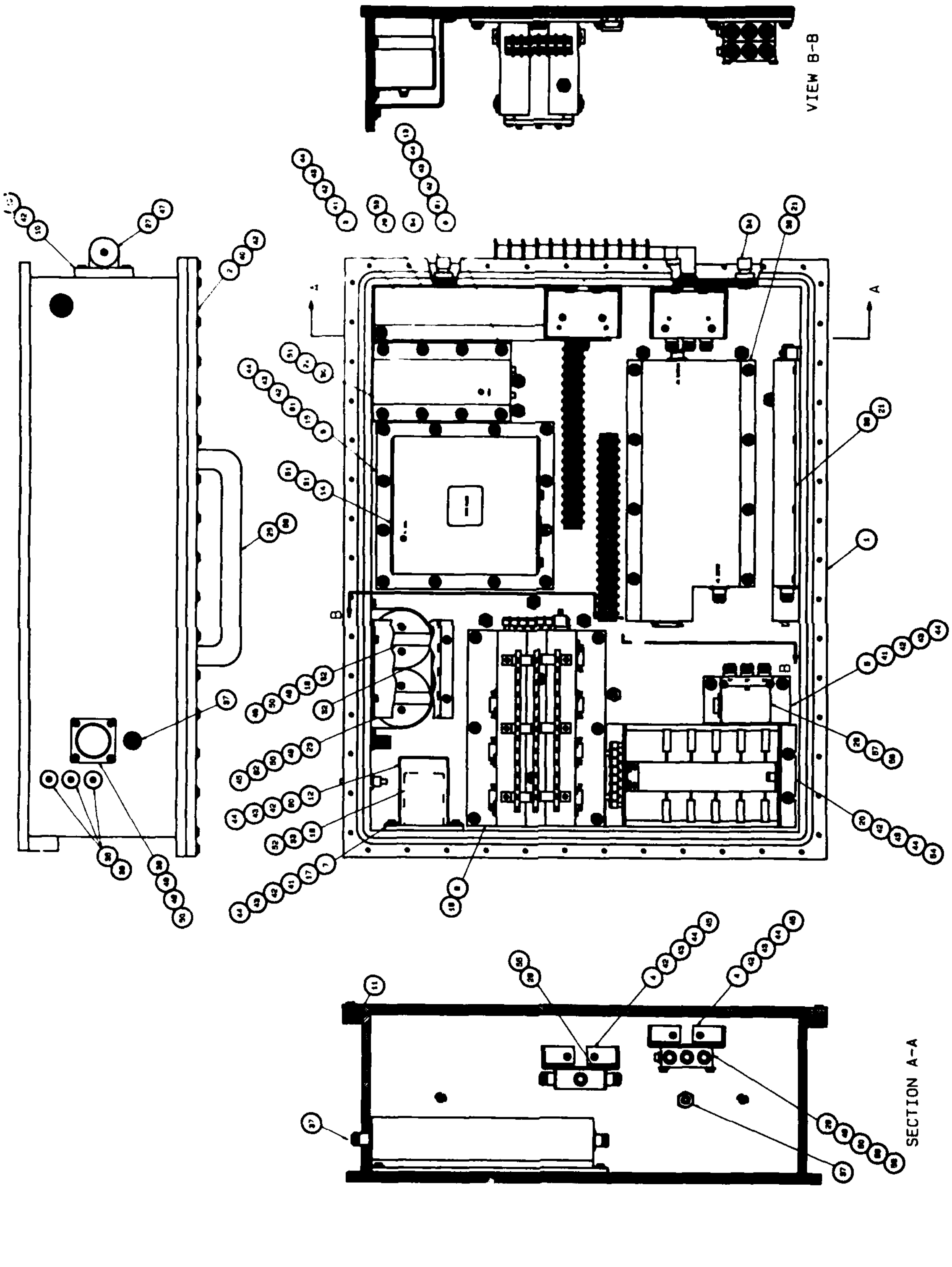


Fig. 1 — L-Band transmitter

	2	62				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X .625	
	20	61		08540	8239-SS-1032	CAPTIVE PANEL SCREW	
	2	60		08540	8237-SS-1032	CAPTIVE PANEL SCREW	
	4	59			MS35649-284	NUT, HEX	
	4	58				SCREW, FLAT HEAD, SLOTTED, 82° .25X20 X .625	CRES
	2	57				SCREW, FLAT-HEAD, SLOTTED, 82° #8-32UNC X 2.50	
	2	56				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X 1.375	
	2	55				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X .375	
	4	54				SCREW, PAN-HEAD, SLOTTED, #10-32UNF X .500	
	4	53				SCREW, FLAT-HEAD, SLOTTED, 82° #10-32UNF X .50	
	8	52				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X .250	
	8	51				SCREW, FLAT-HEAD, SLOTTED, 82° 25-28UNF X .750	CRES
	12	50			MS35338-137	WASHER, LOCK	
	12	49			MS15795-807	WASHER, FLAT	
	8	48				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X .375	CRES
	4	47				SCREW, PAN-HEAD, SLOTTED, #8-32UNC X 1.00	
	4	46				SCREW, PAN-HEAD, SLOTTED, #10-32UNF X .750	
	8	45				SCREW, PAN-HEAD, SLOTTED, #10-32UNF X .625	CRES
	108	44			MS35338-138	WASHER, LOCK	
	108	43			MS15795-808	WASHER, FLAT	
	108	42		08540	2225-N194	NYLON WASHER, FLAT	
	108	41		08540	8238-SS-1032	CAPTIVE PANEL SCREW	
	54	40		08540	8240-SS-1032	CAPTIVE PANEL SCREW	
	3	39		75915		FUSE	
	2	38		50311	RF 1435C	SOLID STATE L-BAND POWER MODULE	
	2	37		77820	UG-30D/U	RF CONNECTOR	
	1	36		77820	MS3102E-32-8P	BOX-MOUNTING RECEPTACLE	
	3	35		75915	340 287	3AG PANEL FUSE HOLDER	
	2	34		02570	SS-800-1-OR	O-SEAL STRAIGHT THREAD CONNECTOR	
	1	33		05245	MODEL 10SP1A	POWER LINE FILTER	
	2	32		90201	CGS383U050X3L	CAPACITOR, 38000MFD, 50VDC	
	1	31		04971	MODEL 1405	1400 SERIES POWER SUPPLY	
	1	30		04971	MODEL 1101	1100 SERIES POWER SUPPLY	
	1	29			MODEL 311	CIRCULATOR	
	3	28		12598	MODEL S-3388	RF COAXIAL SWITCH	
	1	27		12598	MODEL T-21/1	TERMINATION	
	1	26		50140	[illegible]	NARROW BAND FILTER	
	2	25		51508	8578-A	HANDLE	
		24					
	1	23	D	81995		COVER, CAPACITOR	
	1	22	C	81995		GASKET, 1100 SERIES POWER SUPPLY	
	2	21	D			GASKET, POWER MODULE	
	1	20	D			CARD FILE, ASSEMBLY	
	1	19	C			STRAP, CAPACITOR	
	1	18	D			GASKET, MODULATOR/REGULATOR	
	1	17	C			GASKET, MOUNTING PLATE	
	1	16	C			GASKET, POWER LINE FILTER	
	1	15	D			GASKET, MOUNTING PLATE	
	1	14	D			GASKET, 1400 SERIES POWER SUPPLY	
	1	13	C			GASKET, MOUNTING PLATE	
	1	12	D			COVER, POWER LINE FILTER	
	1	11	D			O-RING	
	1	10	C			MOUNTING PLATE, TERMINATION	
	1	9	C			MOUNTING PLATE, 1100 SERIES POWER SUPPLY	
	1	8	D			MOUNTING PLATE, 1400 SERIES POWER SUPPLY	
	1	7	C			MOUNTING PLATE, POWER LINE FILTER	
	1	6	E			MODULATOR/REGULATOR ASSY	
	1	5	C			MOUNTING PLATE, RF COAXIAL SWITCH	
	2	4	C			BRACKET, RF COAXIAL SWITCH & CIRCULATOR	
	1	3	D			MOUNTING PLATE, NARROW BAND FILTER	
	1	2	E			COVER	
	1	1	E	81995		ENCLOSURE	

Fig. 2 — L-Band transmitter

Several mounting brackets and surfaces in the casing require a maximum waviness of 0.006 in. over a length of 4 in. This improves contact between heat-producing components, mounting brackets, and the casing. Improved surface tolerances are required on the modulator/regulator, power amplifiers, power supplies, and the RFI power filter mounting surfaces and brackets.

THERMAL DESIGN CONSIDERATIONS AND CONSTRAINTS

The thermal design of the transmitter allows effective operation during the worst case cycle time consisting of a period of 20 min on, followed by 20 min off. Coated with a low absorptivity-emissivity ratio paint, the exterior of the transmitter is designed to be cooled by natural convection. The ambient design condition consists of a sol-air temperature of 110°F (43°C) with zero wind speed. Interior heat is dissipated through passive design.

Components which generate heat, except the modulator/regulator assembly, have an upper operating temperature of 140°F (60°C). The modulator/regulator is limited by an upper temperature of 160°F (71°C). Thermostats, strategically located throughout the box, detect components that exceed maximum operating temperature and deactivate the power supplies for a minimum of 5 min.

The use of mounting brackets reduces the passive heat dissipation rate by decreasing the overall heat transfer coefficients. The decrease in heat transfer coefficents results from increased heat transfer path and additional contact resistance between surfaces (Fig. 3).

In place of silicone grease, a new thermal conductive product is being used to decrease contact resistance between mating surfaces. This product is a silicone elastomer binder with a thermal conductive filler that forms a flexible conductive pad which has a higher thermal conductivity than grease. The new thermal conductive product replaces silicone grease where modules require electrical isolation or high heat dissipation rates.

THERMAL DESIGN AND ANALYSIS APPROACH

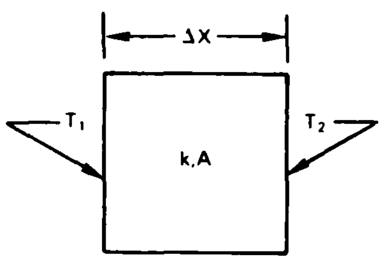
The L-band replacement transmitter is designed to improve the dissipation of heat. Heat dissipation, in turn, is improved by balancing the transfer of heat with short-term thermal storage, without exceeding component temperature limitations. Constraints on the design are large thermal gains over short periods of time, low-temperature gradient within the casing, and limited internal space.

Two design methods were analyzed to determine the most appropriate major form of heat dissipation for this design: the use of conduction heat transfer and thermal storage, and passive convection heat transfer using fin surfaces.

The following heat transfer and capacitance equations were used to evaluate the methods:

Conduction;

$$Q_k = -kA \frac{\Delta T}{\Delta x} \text{ (Btu/h)} \tag{1}$$



$$T_k = T_2 - T_1$$

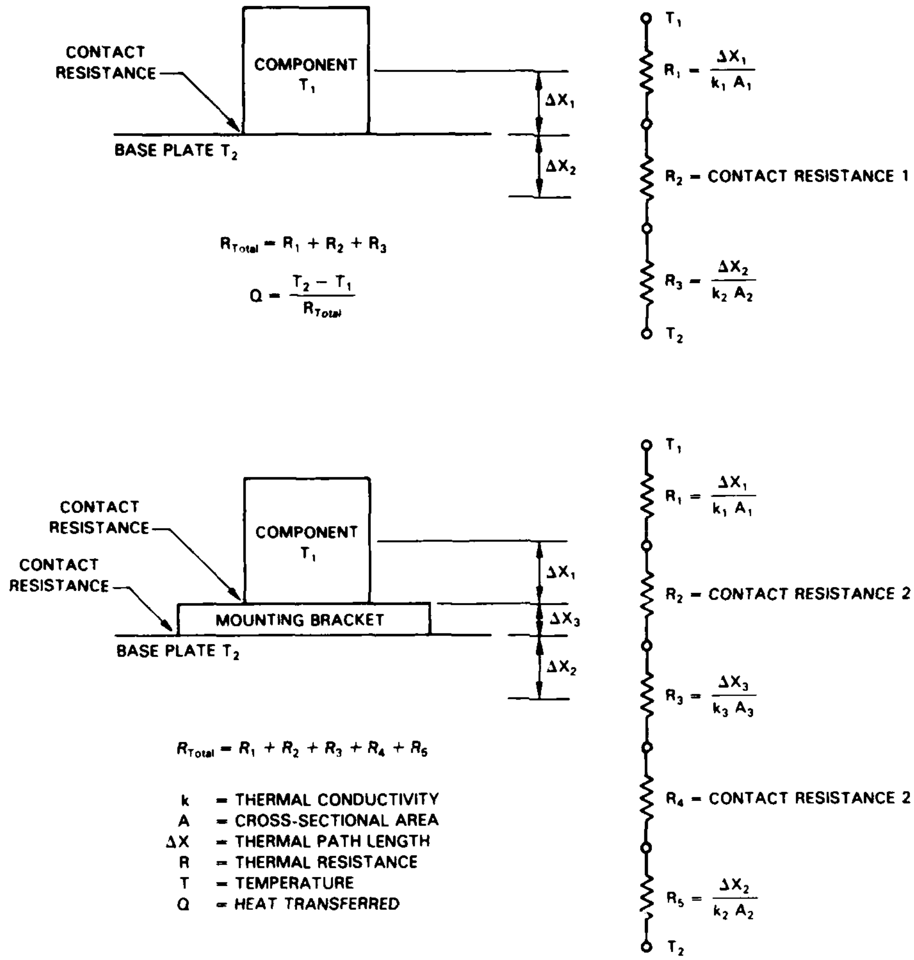
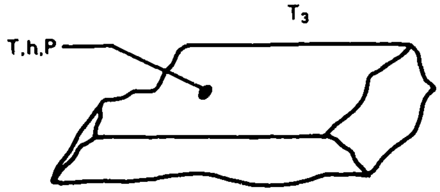


Fig. 3 — Effect of mounting brackets on total thermal resistance

Convection;

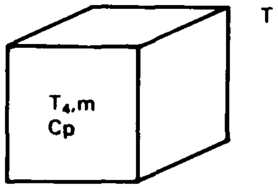
$$Q_h = hP\Delta T_h \text{ (Btu/h)} \tag{2}$$



$$\Delta T_h = T - T_3$$

Capacitance;

$$C = mC_p\Delta T_c \text{ (Btu)} \tag{3}$$



$$\Delta T_c = T_5 - T_4$$

where

k is the conductive heat transfer coefficient (Btu/h· ft · °F)
A is the cross-sectional area in the direction of heat flow (ft^2)
Δx is the heat transfer distance (ft)
ΔT_k is the temperature difference for heat transfer (°F).
h is the convective heat transfer coefficient (Btu/h · ft ^{2} °F)
P is the heat transfer surface area or perimeter (ft^2)
ΔT_h is the temperature difference for heat transfer (°F)
m is the mass (lbm)
C_p is the specific heat (BTM/lbm · °F)
ΔT_c is the temperature difference for thermal storage (°F).

For this design, k,h, and C_p are fixed, and the temperature differences ΔT_k, ΔT_h, and ΔT_c are relatively small. The only coefficients which can be varied to improve heat transfer and storage are A, Δx, P, and m. An increase in A and decrease in Δx improves heat conduction by enlarging the contact area and decreasing the heat transfer path. Increasing P improves convection by increasig the surface area. Increasing m improves the thermal storage capability.

Finned surfaces are recommended when convective heat transfer is the limiting factor in the total dissipation of heat and when 2/k (b · h) > 5, where b is the fin thickness (Fig. 4). Fins are added to the surface P to increase the overall surface area until an optimum solution is reached, where the convective and conductive heat transfer rates are balanced:

$$kA \frac{\Delta T_k}{\Delta x} = hP\ T_h. \tag{4}$$

For this design, the convective heat transfer rate needs to be at least equivalent to conductive heat transfer rate to the baseplate to be the more attractive s olution.

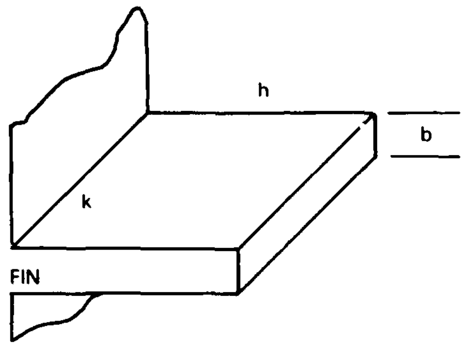


Fig. 4 — Fin surface

The value for ΔT_k and ΔT_h are approximately equal and can be eliminated from the equation. After rearranging terms, the equation for the required convective heat transfer surface, P, becomes:

$$P = \frac{kA}{h\Delta x}. \tag{5}$$

Using the conductive coefficient values for the modulator/regulator,

$$\frac{kA}{\Delta X} = 8.9 \frac{\text{Btu}}{h\ °F}$$

and the convective heat transfer coefficient,

$$h = 0.4 \frac{\text{Btu}}{h\ °F \cdot ft^2}.$$

To calculate the required surface area for equivalent heat transfer, P is equal to 22.25 ft^2. The present surface area is 2.06 ft^2; thus P requires 10.8 times more surface area. With internal space at a premium, the use of fin surfaces as the major form of heat transfer is prohibitive. Fins are used as a secondary source for additional cooling on particular components.

In developing thermal models there are two standard approaches to handling purchased components. The first is to introduce the component as a heat source applied to a surface; the second is to incorporate the component as a physical part of the model. The first approach assumes that the component is not critical to the operation of the design, or that the possibility of thermal failure from this component is minute. The second approach assumes the opposite. This second approach was used throughout the analysis.

Accurate incorporation of component into the system requires the use of detailed manufacturer information. Where manufacturer information was not available or did not exist, visual inspection and available data were used to estimate heat transfer coefficient and capacitance.

THERMAL COMPUTER PROGRAMS

Two main computer programs were used to analyze the thermal characteristics of the transmitter: Radiation View Factor (RAVFAC) and System Improved Numerical Differencing Analyzer (SINDA). These programs were developed for NASA by Lockheed and TRW Corporations, respectively, to analyze space flight equipment. Currently, both programs are recognized and used within the aerospace industry. The programs use finite difference, contour integrals, and other matrix techniques to formulate thermal and general solutions.

RAVFAC develops the blackbody radiation view factor, f_{ij}, to determine radiation exchange between objects. Radiation view factor is defined as the percent of radiation emitted by surface i that

impinges on surface j (Fig. 5). The accuracy of the results are dependent on the number of elements per node and nodes per surface, and the distance between the two surfaces, i and j, relative to the size of the surfaces.

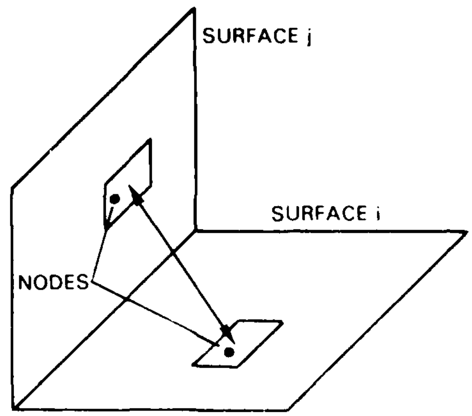


Fig. 5 — Radiation exchange

SINDA uses a resistor-capacitor (R-C) network to represent a thermal system. Each component is represented as a nodal point (s), interconnected to other nodal points by resistors, i.e., conduction, convection, and radiation conductance (Fig. 6). Associated with each node is a thermal capacitance for energy storage. The accuracy of the results are dependent on the number of nodal points used to describe a component and by the accuracy of the heat transfer coefficient and thermal capacitance.

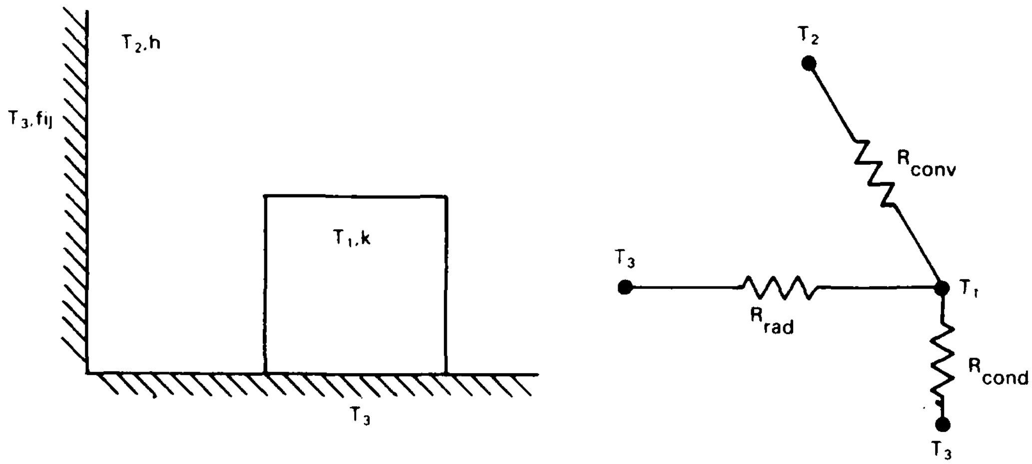


Fig. 6 — R-C network

Several other computer programs are required to generate view factors and to arrange them into a format acceptable to SINDA: Ravplot-three-dimensional plotting program, Copaps-data reduction program, and Script f-data conversion program.

THERMAL MODEL DEVELOPMENT

The RAVFAC data deck for this model is constructed of two-dimensional rectangular and circular plates, and three-dimensional cylinders. Rectangular components are made up of six rectangular plates

to represent the six sides of a box. The capacitors are the only nonrectangular components and are constructed by combining a cylinder with two circular plates. Flat objects such as printed circuit boards are constructed of two rectangular plates facing opposite directions. The walls of the casing are made up of rectangular plates facing into the casing. Appendix A includes a RAVFAC deck.

Each plate is constructed of one node which is subdivided into rectangular elements with the length of each element varying from 1 to 2 in. on a side.

The plotting program Ravplot is used to assure correct orientation of surfaces and components before RAVFAC is executed. Figures 7 and 8 are examples of Ravplot drawings. Appendix B includes Ravplot deck.

The execution of RAVFAC generates view factors for each surface, i.e., six sets of view factors for each box. The program Colaps is used to reduce the data to a more manageable form. Colaps reduces sets of view factors to a single set, i.e., each component becomes a single set. Appendix C shows a Colaps deck.

Script *F* uses surface emissivities, the blackbody view factor and area data from Colaps to generate greybody conductance values. Appendix D includes a Script *F* data deck.

SINDA requires capacitance, conductor, and source data to generate steady state or transient temperatures profiles. Appendix E includes a complete SINDA data deck.

The capacitance (thermal storage) C is specified in units of Btu per °F and is calculated by using either Eq. (6) or (7). The capacitance values are located in the Node Data block.

$$C = mC_p \tag{6}$$

$$C = VC_p \tag{7}$$

where

C is the capacitance	(Btu/°F)
m is the mass	(lbm)
C_p is the specific heat	(Btu/lbm ·°F)
ρ is the density	(lbm/ft^3)
V is the volume	(ft^3).

The conductance uses the format of Eq. (8). The convective and conductive conductors are input as linear conductors into the network solution using Eqs. (9) and (10), respectively.

$$\dot{Q} = G \cdot (T2 - T1) \tag{8}$$

where

$\dot{Q}$ is the heat rate	(Btu/h)
G is the conductance	(Btu/h · °F)
T is the temperature	(°F)

$$G = h \cdot P \tag{9}$$

$$G = k \cdot \frac{A}{x} \tag{10}$$

where

h is the convective film coefficient (Btu/ft^2· h · °F)
P is the surface area (ft^2)
k is the thermal conductivity of the material (Btu/ft · h · °F)
A is the cross-sectional area of the conductive (ft^2)
x is the length of the conductive path (ft).

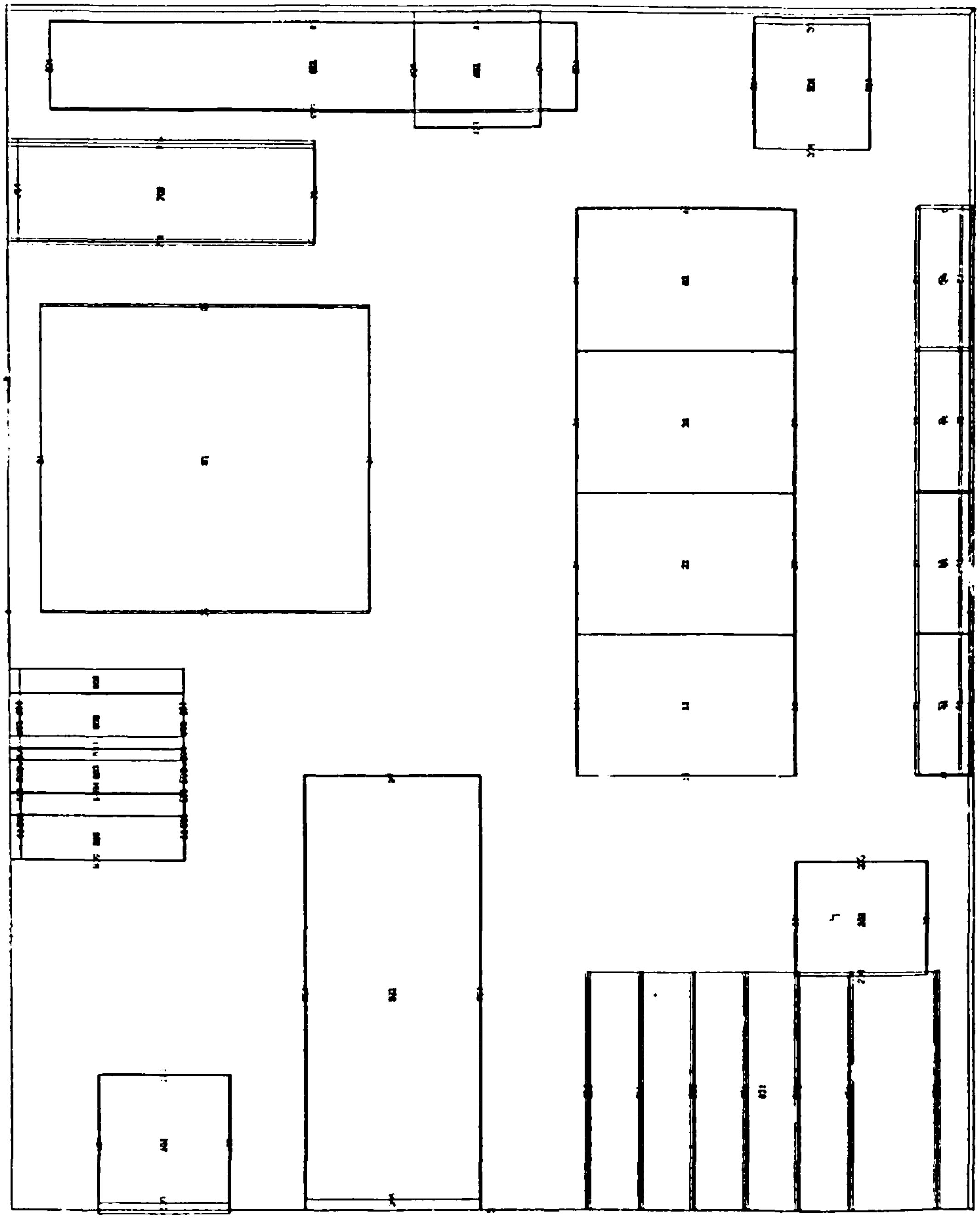


Fig. 7 — RAVPLOT of L-band transmitter

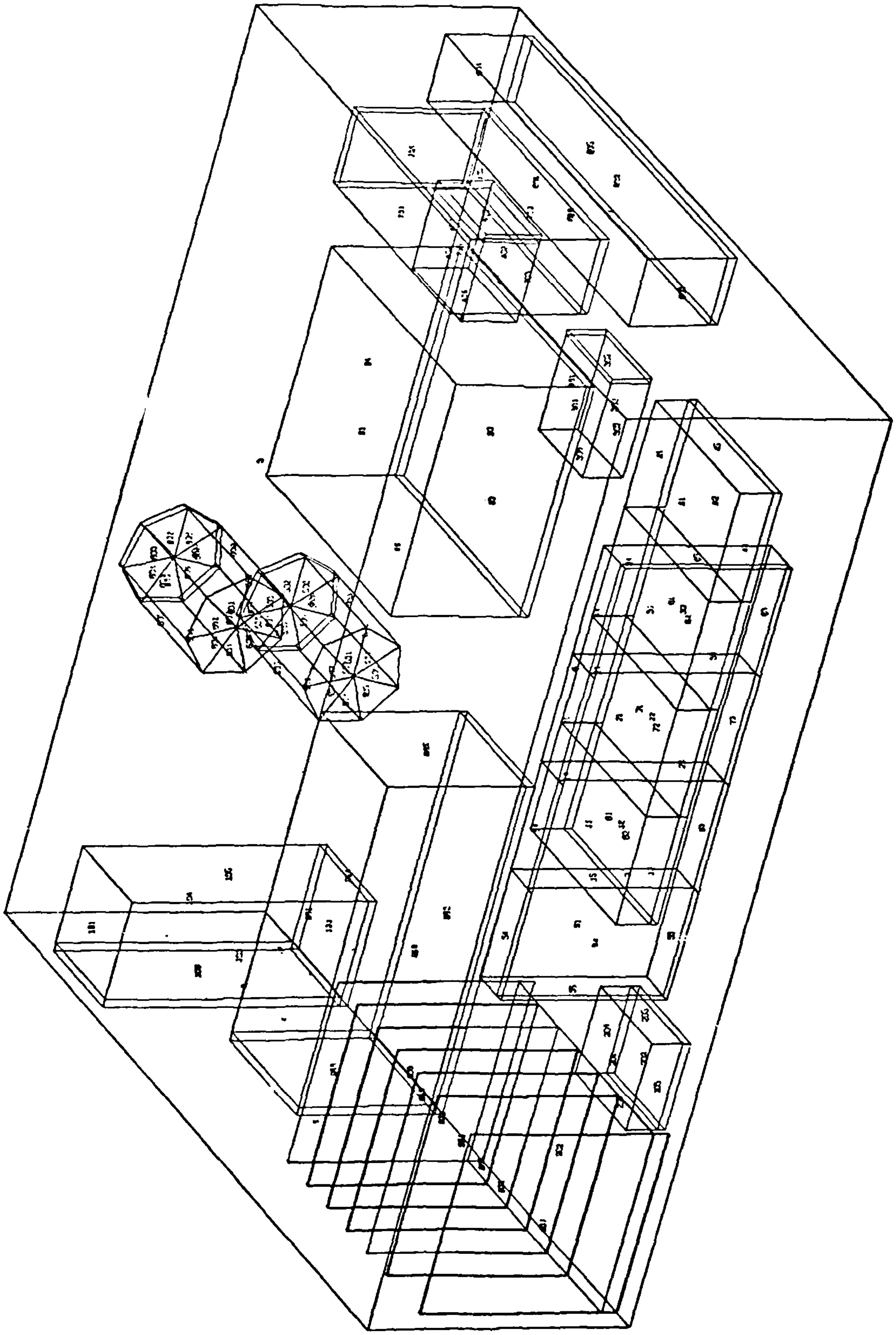


Fig. 8 — RAVPLOT of L-band transmitter

To account for contact resistance between surfaces where the conductive pad is used, the contact area is assumed to be half the plate area. Where the pad is not used, the mounting screw area is assumed to be the contact area.

The radiation conductor is input as a nonlinear conductor using the format of Eq. (11).

$$G = \epsilon\sigma\ FA\,((T + 460))\ ((T\ 460)^2 + (T + 460)^2) \tag{11}$$

where

σ is the Stefan-Boltzman constant 0.1714×10^{-8} (Btu/ft^{2}ċ h · R^4)
ϵ is the emissivity
FA is Script f (ft^2).

The conductors are located in the Conductor Data block.

Heat sources are redefined in each iteration of the analysis. The heat source values are listed in the Constants Data block and redefined in the Variables 1 block.

Time between iterations is 0.5 min with output every 5 min. The cycle time for the first 250 min is 5 min on, followed by 20 min off to stabilize the transmitter cycle temperature. This is followed by a 20 min on, 20 min off worst condition cycle. The final 150 min returns to the original 5 min on, 20 min off cycle. The cycle scheduling is listed in the Execution block.

OBSERVATIONS AND DESIGN MODIFICATIONS

Preliminary results revealed one major and two minor localized hot spots, and three areas of concern with insufficient manufacturer's data.

The modulator/regulator is the most likely component to exceed its temperature limit. Heat is difficult to dissipate due to the small surface area relative to the amount of heat generated by the regulator. A high thermal resistance also exists between the interior of the regulator and its conducting surface. To utilize the available surface area, the regulators are attached to large aluminum blocks. In addition, each regulator is finned for additional heat dissipation. The size and shape of the heat sink/mounting bracket was determined by the available space within the casing (Fig. 9).

The output sections of the power amplifiers are minor areas of concern. The analysis shows that the amplifiers approach their maximum temperature limits as the modulator/regulator reaches its limit. There is sufficient temperature gradient difference between the amplifiers and their limit to allow the modulator/regulator to deactivate the power supplies before the amplifiers reach their maximum temperature. Therefore, no revisions were required in the design.

The three areas of possible concern due to insufficient manufacturer's data were the two power supplies and the RFI power filter. The analysis indicated the three components are operating below their respective critical temperature limits, but due to limited manufacturer's data, the coefficients are of questionable value. The smaller of the two power supplies was opened for visual inspection, and all heat generating components appeared to be well heat sunk. When the unit was bench-tested, it appeared to operate near ambient conditions. The power supplies arrived from the manufacturer with a label requesting adequate heat sinking. To assure proper operation of the two supplies, the mounting bracket thickness was increased to a half inch instead of the quarter inch used on all other brackets.

The RFI power filter is hermetically sealed, which eliminate visual inspection, and requires the manufacturer's limited information be used to calculate the coefficients. The filter was bench-tested and appeared to remain cool. Due to the high electrical efficiency of the filter, the mounting bracket will follow the design of other components until a full-scale test of the transmitter is conducted.

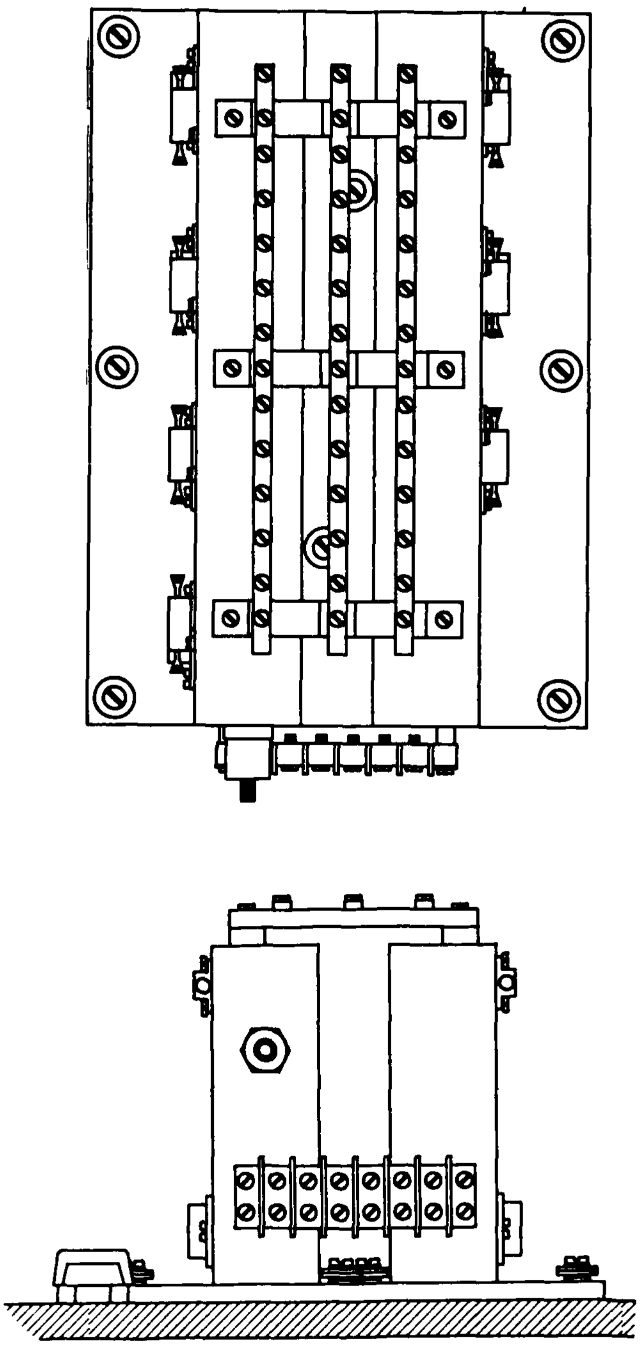


Fig. 9 — Modulator/regulator

CONCLUSION

The thermal analysis predicts that the transmitter is capable of withstanding an ambient sol-air temperature of 110°F (43°C), with no wind, and will operate effectively. The transmitter is also able to withstand extreme environmental conditions without malfunctioning.

During normal operations the interior of the transmitter is designed to minimize component temperature rise. This is accomplished by spreading out the heat generated by the components into the mounting bracket/heat sink. Lower temperature rise will increase the life expectancy of the electronic components.

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Appendix A

RAVFAC

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/ JOB BENNETT,77G126P4,BENNT2,OPT=(C,P),CAT=23
/ LIMIT MIN=30,BAND=150
/ PD MY.USERCAT/D77/F20/BENNT2
/ FD FT06F001.BAND=5/40/5
/ FD FT07F001,BAND=5/50/5
/ FD FT09F001,BAND=5/55/5
/ ASG LRAVFAC,MY/RAVFAC/LRAVFAC,USE=SHR
/ EXQT GO=LRAVFAC.CPTIME=H00000,OPT=(7,A)
 L BAND 1 TRANSMITTER RADIATION ANALYSIS
   1    0    2    2                                                2    -1
  10133                                              RFI POWER FILTER TOP
        1    1    1    2     30.0        0.0         7.5         0.0         3.1875
        0          0.0        0.75       6.0         0.0         0.0         0.0
  10233                                              RFI POWER FILTER BOTTOM
       -1    1    1    2     30.0        0.0         7.5         0.0         3.1875
        0          0.0        0.75       3.5         0.0         0.0         0.0
  10333                                              RFI POWER FILTER FRONT
       -1    1    1    2     30.0        0.0         7.5         0.0         2.5
        0          3.1875     0.75       3.5         0.0         90.0        0.0
  10433                                              RFI POWER FILTER BACK
        1    1    1    2     30.0        0.0         7.5         0.0         2.5
        0          0.25       0.75       3.5         0.0         90.0        0.0
  10533                                              RFI POWER FILTER RIGHT SIDE
       -1    1    1    2     20.0        0.0         2.5         0.0         3.1875
        0          0.0        8.25       3.5         0.0         0.0         90.0
  10633                                              RFI POWER FILTER LEFT SIDE
        1    1    1    2     20.0        0.0         2.5         0.0         3.1875
        0          0.0        0.75       3.5         0.0         0.0         90.0
  20133                                              COAX SWITCH 1 TOP
        1    1    1    2     20.0        0.0         2.625       0.0         3.015
        0          18.0       6.25       1.1875      0.0         0.0         0.0
  20233                                              COAX SWITCH 1 BOTTOM
       -1    1    1    2     20.0        0.0         2.625       0.0         3.015
        0          18.0       6.25       0.25        0.0         0.0         0.0
  20333                                              COAX SWITCH 1 FRONT
       -1    1    1    2     10.0        0.0         2.625       0.0         1.1875
        0          21.015     6.25       0.0         0.0         90.0        0.0
  20433                                              COAX SWITCH 1 BACK
        1    1    1    2     10.0        0.0         2.625       0.0         1.1875
        0          18.0       6.25       0.0         0.0         90.0        0.0
  20533                                              COAX SWITCH 1 RIGHT SIDE
       -1    1    1    1     20.0        0.0         1.1875      0.0         3.015
        0          18.0       8.875      0.0         0.0         0.0         90.0
  20633                                              COAX SWITCH 1 LEFT SIDE
        1    1    1    1     20.0        0.0         1.1875      0.0         3.015
        0          18.0       6.25       0.0         0.0         0.0         90.0
  30133                                              COAX SWITCH 2 TOP
        1    1    1    2     20.0        0.0         3.015       0.0         2.625
        0          17.0       24.385     5.1875      0.0         0.0         0.0
  30233                                              COAX SWITCH 2 BOTTOM
       -1    1    1    2     20.0        0.0         3.015       0.0         2.625
        0          17.0       24.385     4.0         0.0         0.0         0.0
  30333                                              COAX SWITCH 2 FRONT
       -1    1    1    2     10.0        0.0         3.015       0.0         1.1875
        0          19.625     24.385     4.0         0.0         90.0        0.0
  30433                                              COAX SWITCH 2 BACK
        1    1    1    2     10.0        0.0         3.015       0.0         1.1875
        0          17.0       24.385     4.0         0.0         90.0        0.0
  30533                                              COAX SWITCH 2 RIGHT SIDE
       -1    1    1    1     20.0        0.0         1.1875      0.0         2.625
        0          17.0       27.25      4.0         0.0         0.0         90.0
  30633                                              COAX SWITCH 2 LEFT SIDE
        1    1    1    1     20.0        0.0         1.1875      0.0         2.625
        0          17.0       24.385     4.0         0.0         0.0         90.0
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40133                                                     CIRCULATOR TOP
      1     1     1    2     20.0        0.0         2.625       0.0          2.875
      0             9.25       24.875     5.1875      0.0         0.0          0.0
40233                                                     CIRCULATOR BOTTOM
     -1     1     1    2     20.0        0.0         2.625       0.0          2.875
      0             9.25       24.875     3.5         0.0         0.0          0.0
40333                                                     CIRCULATOR FRONT
     -1     1     1    2     10.0        0.0         2.625       0.0          1.6875
      0            12.125      24.875     3.5         0.0         90.0         0.0
40433                                                     CIRCULATOR BACK
      1     1     1    2     10.0        0.0         2.625       0.0          1.6875
      0             9.25       24.875     3.5         0.0         90.0         0.0
40533                                                     CIRCULATOR RIGHT SIDE
     -1     1     1    1     20.0        0.0         1.6875      0.0          2.875
      0             9.25       27.25      3.5         0.0         0.0          90.0
40633                                                     CIRCULATOR LEFT SIDE
      1     1     1    1     20.0        0.0         1.6875      0.0          2.875
      0             9.25       24.875     3.5         0.0         0.0          90.
50133                                                     CAPACITOR 1 TOP
      2     1     7    2     10.0        0.0         1.5         0.1          360.0
      0             5.25        3.00      4.0         0.0         0.0          0.0
50233                                                     CAPACITOR 1 BOTTOM
     -2     1     7    2     10.0        0.0         1.5         0.1          360.0
      0             5.25        3.00      0.250       0.0         0.0          0.0
50333                                                     CAPACITOR 1 SIDE
      4     1     7    2     31.5        0.0         4.0         0.1          360.0
      0             5.25        3.00      0.0         0.0         0.0          0.0
60133                                                     CAPACITOR 2 TOP
      2     1     7    2     10.0        0.0         1.5         0.1          360.0
      0             5.25        6.50      4.0         0.0         0.0          0.0
60233                                                     CAPACITOR 2 BOTTOM
     -2     1     7    2     10.0        0.0         1.5         0.1          360.0
      0             5.25        6.50      0.250       0.0         0.0          0.0
60333                                                     CAPACITOR 2 SIDE
      4     1     7    2     31.5        0.0         4.0         0.1          360.0
      0             5.25        6.50      0.0         0.0         0.0          0.0
70133                                                     POWER SUPPLY 1100 TOP
      1     1     1    2     30.0        0.0         2.25        0.0          7.0
      0             9.25       18.25      4.1875      90.0        0.0          0.0
70233                                                     POWER SUPPLY 1100 BOTTOM
     -1     1     1    2     30.0        0.0         2.25        0.0          7.0
      0             9.25       18.25      0.25        90.0        0.0          0.0
70333                                                     POWER SUPPLY 1100 FRONT
     -1     1     1    2     40.0        0.0         2.25        0.0          4.1875
      0             9.25       11.25      0.0         90.0        90.0         0.0
70433                                                     POWER SUPPLY 1100 BACK
      1     1     1    2     40.0        0.0         2.25        0.0          4.1875
      0             9.25       18.25      0.0         90.0        90.0         0.0
70533                                                     POWER SUPPLY 1100 RIGHT SIDE
     -1     1     1    1     30.0        0.0         4.1875      0.0          7.0
      0            11.5        18.25      0.0         90.0        0.0          90.0
70633                                                     POWER SUPPLY 1100 LEFT SIDE
      1     1     1    1     30.0        0.0         4.1875      0.0          7.0
      0             9.25       18.25      0.0         90.0        0.0          90.0
80133                                                     FILTER TOP
      1     1     1    1     60.0        0.0         2.5         0.0          12.125
      0             0.0        25.0       2.6875      0.0         0.0          0.0
80233                                                     FILTER BOTTOM
     -1     1     1    1     60.0        0.0         2.25        0.0          11.875
      0             0.25       25.0       0.250       0.0         0.0          0.0
80333                                                     FILTER FRONT
     -1     1     1    2     20.0        0.0         2.5         0.0          2.6875
      0            12.125      25.0       0.0         0.0         90.0         0.0
80433                                                     FILTER BACK
      1     1     1    2     20.0        0.0         2.25        0.0          2.6875
      0             0.250      25.0       0.0         0.0         90.0         0.0
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80533                                                       FILTER RIGHT SIDE
      -1    1    1   1    60.0        0.0         2.6875    0.0         12.125
       0         0.0      27.25       0.0         0.0       0.0         90.0
80633                                                       FILTER LEFT SIDE
       1    1    1   1    60.0        0.0         2.6875    0.0         12.125
       0         0.0      25.0        0.0         0.0       0.0         90.0
90133                                                       CARD BUCKET BOTTOM DOWN
      -1    1    1   6    30.0        0.0         8.0       0.0         5.5
       0         13.25    5.5         0.48        90.0      0.0         0.0
90233                                                       CARD BUCKET BOTTOM UP
       1    1    1   6    30.0        0.0         8.0       0.0         5.5
       0         13.25    5.5         0.49        90.0      0.0         0.0
90333                                                       CARD BUCKET RIGHT SIDE OUT
      -1    1    1   3    30.0        0.0         6.0       0.0         5.5
       0         21.25    5.5         0.0         90.0      0.0         90.0
90433                                                       CARD BUCKET RIGHT SIDE IN
       1    1    1   3    30.0        0.0         6.0       0.0         5.5
       0         21.2     5.5         0.0         90.0      0.0         90.0
90533                                                       CARD BUCKET LEFT SIDE OUT
       1    1    1   3    30.0        0.0         6.0       0.0         5.5
       0         13.2     5.5         0.0         90.0      0.0         90.0
90633                                                       CARD BUCKET LEFT SIDE IN
      -1    1    1   3    30.0        0.0         6.0       0.0         5.5
       0         13.25    5.5         0.0         90.0      0.0         90.0
91133                                                       CARD 1 LEFT FACE
       1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         14.4     5.5         0.5         90.0      0.0         90.0
91233                                                       CARD 1 RIGHT FACE
      -1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         14.45    5.5         0.5         90.0      0.0         90.
92133                                                       CARD 2 LEFT FACE
       1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         15.6     5.5         0.5         90.0      0.0         90.
92233                                                       CARD 2 RIGHT FACE
      -1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         15.65    5.5         0.5         90.0      0.0         90.
93133                                                       CARD 3 LEFT FACE
       1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         16.8     5.5         0.5         90.0      0.0         90.
93233                                                       CARD 3 RIGHT FACE
      -1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         16.85    5.5         0.5         90.0      0.0         90.
94133                                                       CARD 4 LEFT FACE
       1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         18.0     5.5         0.5         90.0      0.0         90.0
94233                                                       CARD 4 RIGHT FACE
      -1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         18.05    5.5         0.5         90.0      0.0         90.
95133                                                       CARD 5 LEFT FACE
       1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         19.2     5.5         0.5         90.0      0.0         90.
95233                                                       CARD 5 RIGHT FACE
      -1    1    1   3    30.0        0.0         5.5       0.0         5.5
       0         19.25    5.5         0.5         90.0      0.0         90.
96133                                                       REGULATOR TOP
       1    1    1   1    30.0        0.0         0.75      0.0         5.5
       0         6.5      0.0         6.0         0.0       0.0         0.0
96333                                                       REGULATOR FRONT
      -1    1    1   1    30.0        0.0         0.75      0.0         6.0
       0         12.0     0.0         0.0         0.0       90.0        0.0
96433                                                       REGULATOR BACK
       1    1    1   1    30.0        0.0         0.75      0.0         6.0
       0         6.5      0.0         0.0         0.0       90.0        0.0
96533                                                       REGULATOR RIGHT SIDE
      -1    1    1   3    30.0        0.0         6.0       0.0         5.5
       0         6.5      0.75        0.0         0.0       0.0         90.0
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[illegible]                                               REGULATOR LEFT SIDE
       1      1      1    3     30.0        0.0          5.75        0.0          5.5
       0             6.5         0.25       0.25         0.0         0.0          90.0
1133                                                     AMP 1 TOP #1
       1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        10.0       1.25         0.0         0.0          0.0
1233                                                     AMP 1 BOTTOM #1
      -1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        10.0       0.250        0.0         0.0          0.0
1333                                                     AMP 1 FRONT #1
      -1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             18.0        10.0       0.0          0.0         90.0         0.0
1433                                                     AMP 1 BACK #1
       1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             13.0        10.0       0.0          0.0         90.0         0.0
1533                                                     AMP 1 LEFT SIDE #1
       1      1      1    1     30.0        0.0          1.25        0.0          5.0
       0             13.0        10.0       0.0          0.0         0.0          90.
2133                                                     AMP 1 TOP #2
       1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        13.25      1.25         0.0         0.0          0.0
2233                                                     AMP 1 BOTTOM #2
      -1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        13.25      0.250        0.0         0.0          0.0
2333                                                     AMP 1 FRONT #2
      -1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             18.0        13.25      0.0          0.0         90.0         0.0
2433                                                     AMP 1 BACK #2
       1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             13.0        13.25      0.0          0.0         90.0         0.0
3133                                                     AMP 1 TOP #3
       1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        16.5       1.25         0.0         0.0          0.0
3233                                                     AMP 1 BOTTOM #3
      -1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        16.5       0.250        0.0         0.0          0.0
3333                                                     AMP 1 FRONT #3
      -1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             18.0        16.5       0.0          0.0         90.0         0.0
3433                                                     AMP 1 BACK #3
       1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             13.0        16.5       0.0          0.0         90.0         0.0
4133                                                     AMP 1 TOP #4
       1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        19.75      1.25         0.0         0.0          0.0
4233                                                     AMP 1 BOTTOM #4
      -1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             13.0        19.75      0.250        0.0         0.0          0.0
4333                                                     AMP 1 FRONT #4
      -1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             18.0        19.75      0.0          0.0         90.0         0.0
4433                                                     AMP 1 BACK #4
       1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             13.0        19.75      0.0          0.0         90.0         0.0
4533                                                     AMP 1 RIGHT SIDE #4
      -1      1      1    1     30.0        0.0          1.25        0.0          5.0
       0             13.0        23.00      0.0          0.0         0.0          90.0
5133                                                     AMP 2 TOP #1
       1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             20.75       10.0       0.75         0.0         90.0         0.0
5233                                                     AMP 2 BOTTOM #1
      -1      1      1    2     30.0        0.0          3.25        0.0          5.0
       0             21.75       10.0       0.75         0.0         90.0         0.0
5333                                                     AMP 2 FRONT #1
      -1      1      1    2     10.0        0.0          3.25        0.0          1.25
       0             20.75       10.0       0.75         0.0         0.0          0.0
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5433                                                   AMP 2 BACK #1
        1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    10.0       5.75         0.0        0.0       0.0
5533                                                   AMP 2 LEFT SIDE #1
       -1     1     1   1     30.0       0.0          1.25       0.0       5.0
        0             20.75    10.0       0.75         90.0       90.0      0.0
6133                                                   AMP 2 TOP #2
        1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             20.75    13.25      0.75         0.0        90.0      0.0
6233                                                   AMP 2 BOTTOM #2
       -1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             21.75    13.25      0.75         0.0        90.0      0.0
6333                                                   AMP 2 FRONT #2
       -1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    13.25      0.75         0.0        0.0       0.0
6433                                                   AMP 2 BACK #2
        1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    13.25      5.75         0.0        0.0       0.0
7133                                                   AMP 2 TOP #3
        1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             20.75    16.5       0.75         0.0        90.0      0.0
7233                                                   AMP 2 BOTTOM #3
       -1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             21.75    16.5       0.75         0.0        90.0      0.0
7333                                                   AMP 2 FRONT #3
       -1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    16.5       0.75         0.0        0.0       0.0
7433                                                   AMP 2 BACK #3
        1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    16.5       5.75         0.0        0.0       0.0
8133                                                   AMP 2 TOP #4
        1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             20.75    19.75      0.75         0.0        90.0      0.0
8233                                                   AMP 2 BOTTOM #4
       -1     1     1   2     30.0       0.0          3.25       0.0       5.0
        0             21.75    19.75      0.75         0.0        90.0      0.0
8333                                                   AMP 2 FRONT #4
       -1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    19.75      0.75         0.0        0.0       0.0
8433                                                   AMP 2 BACK #4
        1     1     1   2     10.0       0.0          3.25       0.0       1.25
        0             20.75    19.75      5.75         0.0        0.0       0.0
8533                                                   AMP 2 RIGHT SIDE #4
        1     1     1   1     30.0       0.0          1.25       0.0       5.0
        0             20.75    23.00      0.75         90.0       90.0      0.0
9133                                                 - POWER SUPPLY 1400 TOP
       -1     1     1   3     50.0       0.0          7.0        0.0       11.0
        0             0.750    23.0       4.1875       90.        0.0       0.0
9233                                                   POWER SUPPLY 1400 BOTTOM
       -1     1     1   3     50.0       0.0          7.0        0.0       11.
        0             0.750    23.0       0.250        90.0       0.0       0.0
9333                                                   POWER SUPPLY 1400 FRONT
       -1     1     1   3     20.0       0.0          7.0        0.0       4.1875
        0             0.750    23.0       0.0          90.0       90.0      0.0
9433                                                   POWER SUPPLY 1400 BACK
        1     1     1   3     20.0       0.0          7.0        0.0       4.1875
        0             0.750    12.0       0.0          90.0       90.0      0.0
9533                                                   POWER SUPPLY 1400 RIGHT SIDE
       -1     1     1   2     50.0       0.0          4.1875     0.0       11.
        0             0.750    23.0       0.0          90.0       0.0       90.0
9633                                                   POWER SUPPLY 1400 LEFT SIDE
        1     1     1   2     50.0       0.0          4.1875     0.0       11.0
        0             7.75     23.0       0.0          90.0       0.0       90.0
133                                                    CASING TOP
       -1     1     1   7     60.0       0.0          27.5       0.0       22.
        0             0.0      0.0        6.5          0.0        0.0       0.0
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  233                                                CASING FRONT
        1     1     1  14     30.0        0.0        27.5       0.0        6.5
        0           22.0       0.0        0.0        0.0        90.0       0.0
  333                                                CASING BACK
       -1     1     1  14     30.0        0.0        27.5       0.0        6.5
        0            0.0       0.0        0.0        0.0        90.0       0.0
  433                                                CASING RIGHT SIDE
        1     1     1   6    220.0        0.0        6.5        0.0        22.
        0            0.0        27.5      0.0        0.0        0.0        90.
  533                                                CASING LEFT SIDE
       -1     1     1   3    110.0        0.0        6.5        0.0        22.
        0            0.0       0.0        0.0        0.0        0.0        90.
  633                                                CASING BOTTOM
        1     1     1  14    110.0        0.0        27.5       0.0        22.
        0            0.0       0.0        0.0        0.0        0.0        0.0
    -1
END
/ CATV MY/LBAND2/RAVFAC/RAVOUT,ACNM=FT07F001
/ FOSYS FT07F001
/ EOJ
```

Appendix B

RAVPLOT

```
/ JOB BENNETT,7761234,BENNT2,OPT=(C,P),CAT=17
/ LIMIT MIN=5,CARD=150
/ PC HIS,USERCAT/077/22/BENNT2
/ FC FT06F001,CARD=5/4075
/ ASG LRVPLOT2,HIS/LRVPLOT2,USE=SHR
/ EXUT 05=LRVPLOT2
L BAND 1 TRANSMITTER RADIATION ANALYSIS
                                                                                2     1
   1     .     2     2
                                                              RFI POWER FILTER TOP
  10133
         1     1     1     2     30.0        0.0        3.1875     0.0        7.5
         0           0.75        0.75        0.0        0.0        0.0        90.0
                                                              RFI POWER FILTER BOTTOM
  10233
        -1     1     1     2     30.0        0.0        3.1875     0.0        7.5
         0           0.75        4.5         0.0        0.0        0.0        90.0
                                                              RFI POWER FILTER FRONT
  10333
        -1     1     1     2     20.0        0.0        3.75       0.0        3.1875
         0           8.25        0.75        0.0        0.0        90.0       0.0
                                                              RFI POWER FILTER BACK
  10433
         1     1     1     2     20.0        0.0        3.75       0.0        3.1875
         0           0.75        0.75        0.0        0.0        90.0       0.0
                                                              RFI POWER FILTER RIGHT SIDE
  10533
        -1     1     1     2     30.0        0.0        3.75       0.0        7.5
         0           3.75        0.75        3.1875     0.0        0.0        0.0
                                                              RFI POWER FILTER LEFT SIDE
  10633
         1     1     1     2     30.0        0.0        3.75       0.0        7.5
         0           0.750       0.75        0.0        0.0        0.0        0.0
                                                              COAX SWITCH 1 TOP
  20133
         1     1     1     2     20.0        0.0        2.625      0.0        3.015
         0           0.0         8.5         4.1875     90.0       0.0        0.0
                                                              COAX SWITCH 1 BOTTOM
  20233
        -1     1     1     2     20.0        0.0        2.625      0.0        3.015
         0           0.0         8.5         3.0        90.0       0.0        0.0
                                                              COAX SWITCH 1 FRONT
  20333
        -1     1     1     2     10.0        0.0        2.625      0.0        1.1875
         0           0.0         5.485       3.0        90.0       90.0       0.0
                                                              COAX SWITCH 1 BACK
  20433
         1     1     1     2     10.0        0.0        2.625      0.0        1.1875
         0           0.0         8.5         3.0        90.0       90.0       0.0
                                                              COAX SWITCH 1 RIGHT SIDE
  20533
        -1     1     1     1     20.0        0.0        1.1875     0.0        3.015
         0           2.625       8.5         3.0        90.0       0.0        90.0
                                                              COAX SWITCH 1 LEFT SIDE
  20633
         1     1     1     1     20.0        0.0        1.1875     0.0        3.015
         0           0.25        6.5         3.0        90.0       0.0        90.0
                                                              COAX SWITCH 2 TOP
  30133
         1     1     1     2     20.0        0.0        3.015      0.0        2.625
         0           2.0         25.485      5.1875     0.0        0.0        0.0
                                                              COAX SWITCH 2 BOTTOM
  30233
        -1     1     1     2     20.0        0.0        3.015      0.0        2.625
         0           2.0         25.485      4.0        0.0        0.0        0.0
                                                              COAX SWITCH 2 FRONT
  30333
        -1     1     1     2     10.0        0.0        3.015      0.0        1.1875
         0           4.625       25.485      4.0        0.0        90.0       0.0
                                                              COAX SWITCH 2 BACK
  30433
         1     1     1     2     10.0        0.0        3.015      0.0        1.1875
         0           2.0         25.485      4.0        0.0        90.0       0.0
                                                              COAX SWITCH 2 RIGHT SIDE
  30533
        -1     1     1     1     20.0        0.0        1.1875     0.0        2.625
         0           2.0         29.25       4.0        0.0        0.0        90.0
                                                              COAX SWITCH 2 LEFT SIDE
  30633
         1     1     1     1     20.0        0.0        1.1875     0.0        2.625
         0           2.0         25.485      4.0        0.0        0.0        90.0
                                                              CIRCULATOR TOP
  40133
         1     1     1     2     20.0        0.0        2.625      0.0        2.875
```

```
          0          9.25      25.875      5.1875      0.0       0.0       0.0
40233                                                  CIRCULATOR BOTTOM
         -1     1    1    2    20.0        0.0         2.625     0.0       2.875
          0          9.25      25.875      3.5         0.0       0.0       0.0
40333                                                  CIRCULATOR FRONT
         -1     1    1    2    10.0        0.0         2.625     0.0       1.6875
          0          12.125    25.875      3.5         0.0       90.0      0.0
40433                                                  CIRCULATOR BACK
          1     1    1    2    10.0        0.0         2.625     0.0       1.6875
          0          9.25      25.875      3.5         0.0       90.0      0.0
40533                                                  CIRCULATOR RIGHT SIDE
         -1     1    1    1    20.0        0.0         1.6875    0.0       2.875
          0          9.25      29.25       3.5         0.0       0.0       90.0
40633                                                  CIRCULATOR LEFT SIDE
          1     1    1    1    20.0        0.0         1.6875    0.0       2.875
          0          9.25      25.875      3.5         0.0       0.0       90.
50133                                                  CAPACITOR 1 TOP
          2     1    7    2    10.0        0.0         1.5       0.1       360.0
          0          16.25     14.5        4.0         0.0       0.0       0.0
50233                                                  CAPACITOR 1 BOTTOM
         -2     1    7    2    10.0        0.0         1.5       0.1       360.0
          0          16.25     14.5        0.250       0.0       0.0       0.0
50333                                                  CAPACITOR 1 SIDE
          4     1    7    2    31.5        0.0         4.0       0.1       360.0
          0          16.25     14.5        0.0         0.0       0.0       0.0
60133                                                  CAPACITOR 2 TOP
          2     1    7    2    10.0        0.0         1.5       0.1       360.0
          0          20.25     14.5        4.0         0.0       0.0       0.0
60233                                                  CAPACITOR 2 BOTTOM
         -2     1    7    2    10.0        0.0         1.5       0.1       360.0
          0          20.25     14.5        0.250       0.0       0.0       0.0
60333                                                  CAPACITOR 2 SIDE
          4     1    7    2    31.5        0.0         4.0       0.1       360.0
          0          20.25     14.5        0.0         0.0       0.0       0.0
70133                                                  POWER SUPPLY 1100 TOP
          1     1    1    2    30.0        0.0         2.25      0.0       7.0
          0          15.0      9.25        4.1875      0.0       0.0       0.0
70233                                                  POWER SUPPLY 1100 BOTTOM
         -1     1    1    2    30.0        0.0         2.25      0.0       6.75
          0          15.0      9.25        0.250       0.0       0.0       0.0
70333                                                  POWER SUPPLY 1100 FRONT
         -1     1    1    2    40.0        0.0         2.25      0.0       4.1875
          0          21.75     9.25        0.0         0.0       90.0      0.0
70433                                                  POWER SUPPLY 1100 BACK
          1     1    1    2    40.0        0.0         2.25      0.0       4.1875
          0          15.0      9.25        0.0         0.0       90.0      0.0
70533                                                  POWER SUPPLY 1100 RIGHT SIDE
         -1     1    1    1    30.0        0.0         4.1875    0.0       7.0
          0          15.0      11.50       0.0         0.0       0.0       90.0
70633                                                  POWER SUPPLY 1100 LEFT SIDE
          1     1    1    1    30.0        0.0         4.1875    0.0       7.0
          0          15.0      9.25        0.0         0.0       0.0       90.0
80133                                                  FILTER TOP
          1     1    1    1    60.0        0.0         2.5       0.0       12.125
          0          0.0       26.0        2.6875      0.0       0.0       0.0
80233                                                  FILTER BOTTOM
         -1     1    1    1    60.0        0.0         2.25      0.0       11.875
          0          0.25      26.0        0.250       0.0       0.0       0.0
80333                                                  FILTER FRONT
         -1     1    1    2    20.0        0.0         2.5       0.0       2.6875
          0          12.125    26.0        0.0         0.0       90.0      0.0
80433                                                  FILTER BACK
          1     1    1    2    20.0        0.0         2.25      0.0       2.6875
          0          0.250     26.0        0.0         0.0       90.0      0.0
80533                                                  FILTER RIGHT SIDE
         -1     1    1    1    60.0        0.0         2.6875    0.0       12.125
```

```
        0              0.0        28.25       0.0         0.0        0.0          90.0
80633                                                    FILTER LEFT SIDE
        1      1      1    1     60.0        0.0         2.6875     0.0          12.125
        0              0.0        26.0        0.0         0.0        0.0          90.0
90133                                                    CARD BUCKET BOTTOM DOWN
       -1      1      1    6     30.0        0.0         11.5       0.0          5.5
        0             16.5        17.0        0.48        0.0        0.0          0.0
90233                                                    CARD BUCKET BOTTOM UP
        1      1      1    6     30.0        0.0         11.5       0.0          5.5
        0             16.5        17.0        0.49        0.0        0.0          0.0
90333                                                    CARD BUCKET RIGHT SIDE OUT
       -1      1      1    3     30.0        0.0         6.0        0.0          5.5
        0             16.5        28.45       0.0         0.0        0.0          90.0
90433                                                    CARD BUCKET RIGHT SIDE IN
        1      1      1    3     30.0        0.0         6.0        0.0          5.5
        0             16.5        28.4        0.0         0.0        0.0          90.0
90533                                                    CARD BUCKET LEFT SIDE OUT
        1      1      1    3     30.0        0.0         6.0        0.0          5.5
        0             16.5        17.0        0.0         0.0        0.0          90.0
90633                                                    CARD BUCKET LEFT SIDE IN
       -1      1      1    3     30.0        0.0         6.0        0.0          5.5
        0             16.5        17.05       0.0         0.0        0.0          90.0
91133                                                    CARD 1 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        18.41       0.5         0.0        0.0          90.0
91233                                                    CARD 1 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        18.43       0.5         0.0        0.0          90.
92133                                                    CARD 2 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        19.84       0.5         0.0        0.0          90.
92233                                                    CARD 2 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        19.86       0.5         0.0        0.0          90.
93133                                                    CARD 3 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        21.27       0.5         0.0        0.0          90.
93233                                                    CARD 3 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        21.29       0.5         0.0        0.0          90.
94133                                                    CARD 4 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        22.7        0.5         0.0        0.0          90.0
94233                                                    CARD 4 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        22.72       0.5         0.0        0.0          90.
95133                                                    CARD 5 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        24.13       0.5         0.0        0.0          90.
95233                                                    CARD 5 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        24.15       0.5         0.0        0.0          90.
96133                                                    CARD 6 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        25.56       0.5         0.0        0.0          90.
96233                                                    CARD 6 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        25.58       0.5         0.0        0.0          90.
97133                                                    CARD 7 LEFT FACE
        1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        27.0        0.5         0.0        0.0          90.
97233                                                    CARD 7 RIGHT FACE
       -1      1      1    3     30.0        0.0         5.5        0.0          5.5
        0             16.5        27.02       0.5         0.0        0.0          90.
 1133                                                    AMP 1 TOP #1
        1      1      1    2     30.0        0.0         3.25       0.0          5.0
```

```
            0                7.25      10.0       1.25       0.0        0.0        0.0
1233                                                         AMP 1 BOTTOM #1
         -1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      10.0       0.250      0.0        0.0        0.0
1333                                                         AMP 1 FRONT #1
         -1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              12.25     10.0       0.0        0.0        90.0       0.0
1433                                                         AMP 1 BACK #1
          1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              7.25      10.0       0.0        0.0        90.0       0.0
1533                                                         AMP 1 LEFT SIDE #1
          1      1      1     1      30.0       0.0        1.25       0.0        5.0
          0              7.25      10.0       0.0        0.0        0.0        90.
2133                                                         AMP 1 TOP #2
          1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      13.25      1.25       0.0        0.0        0.0
2233                                                         AMP 1 BOTTOM #2
         -1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      13.25      0.250      0.0        0.0        0.0
2333                                                         AMP 1 FRONT #2
         -1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              12.25     13.25      0.0        0.0        90.0       0.0
2433                                                         AMP 1 BACK #2
          1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              7.25      13.25      0.0        0.0        90.0       0.0
3133                                                         AMP 1 TOP #3
          1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      16.5       1.25       0.0        0.0        0.0
3233                                                         AMP 1 BOTTOM #3
         -1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      16.5       0.250      0.0        0.0        0.0
3333                                                         AMP 1 FRONT #3
         -1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              12.25     16.5       0.0        0.0        90.0       0.0
3433                                                         AMP 1 BACK #3
          1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              7.25      16.5       0.0        0.0        90.0       0.0
4133                                                         AMP 1 TOP #4
          1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      19.75      1.25       0.0        0.0        0.0
4233                                                         AMP 1 BOTTOM #4
         -1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              7.25      19.75      0.250      0.0        0.0        0.0
4333                                                         AMP 1 FRONT #4
         -1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              12.25     19.75      0.0        0.0        90.0       0.0
4433                                                         AMP 1 BACK #4
          1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              7.25      19.75      0.0        0.0        90.0       0.0
4533                                                         AMP 1 RIGHT SIDE #4
         -1      1      1     1      30.0       0.0        1.25       0.0        5.0
          0              7.25      23.00      0.0        0.0        0.0        90.0
5133                                                         AMP 2 TOP #1
          1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              0.75      10.0       1.25       0.0        0.0        0.0
5233                                                         AMP 2 BOTTOM #1
         -1      1      1     2      30.0       0.0        3.25       0.0        5.0
          0              0.75      10.0       0.250      0.0        0.0        0.0
5333                                                         AMP 2 FRONT #1
         -1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              5.75      10.0       0.0        0.0        90.0       0.0
5433                                                         AMP 2 BACK #1
          1      1      1     2      10.0       0.0        3.25       0.0        1.25
          0              0.75      10.0       0.0        0.0        90.0       0.0
5533                                                         AMP 2 LEFT SIDE #1
          1      1      1     1      30.0       0.0        1.25       0.0        5.0
```

```
       0               0.75      10.0      0.0       0.0       0.0       90.
6133                                                 AMP 2 TOP #2
       1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      13.25     1.25      0.0       0.0       0.0
6233                                                 AMP 2 BOTTOM #2
      -1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      13.25     0.250     0.0       0.0       0.0
6333                                                 AMP 2 FRONT #2
      -1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               5.75      13.25     0.0       0.0       90.0      0.0
6433                                                 AMP 2 BACK #2
       1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               0.75      13.25     0.0       0.0       90.0      0.0
7133                                                 AMP 2 TOP #3
       1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      16.5      1.25      0.0       0.0       0.0
7233                                                 AMP 2 BOTTOM #3
      -1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      16.5      0.250     0.0       0.0       0.0
7333                                                 AMP 2 FRONT #3
      -1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               5.75      16.5      0.0       0.0       90.0      0.0
7433                                                 AMP 2 BACK #3
       1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               0.75      16.5      0.0       0.0       90.0      0.0
8133                                                 AMP 2 TOP #4
       1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      19.75     1.25      0.0       0.0       0.0
8233                                                 AMP 2 BOTTOM #4
      -1      1      1    2      30.0      0.0       3.25      0.0       5.0
       0               0.75      19.75     0.250     0.0       0.0       0.0
8333                                                 AMP 2 FRONT #4
      -1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               5.75      19.75     0.0       0.0       90.0      0.0
8433                                                 AMP 2 BACK #4
       1      1      1    2      10.0      0.0       3.25      0.0       1.25
       0               0.75      19.75     0.0       0.0       90.0      0.0
8533                                                 AMP 2 RIGHT SIDE #4
      -1      1      1    1      30.0      0.0       1.25      0.0       5.0
       0               0.75      23.00     0.0       0.0       0.0       90.0
9133                                                 POWER SUPPLY 1400 TOP
       1      1      1    3      50.0      0.0       7.0       0.0       11.0
       0              10.75       0.75     4.1875    0.0       0.0       0.0
9233                                                 POWER SUPPLY 1400 BOTTOM
      -1      1      1    3      50.0      0.0       7.0       0.0       11.
       0              10.75       0.75     0.250     0.0       0.0       0.0
9333                                                 POWER SUPPLY 1400 FRONT
      -1      1      1    3      20.0      0.0       7.0       0.0       4.1875
       0              21.75       0.75     0.0       0.0       90.0      0.0
9433                                                 POWER SUPPLY 1400 BACK
       1      1      1    3      20.0      0.0       7.0       0.0       4.1875
       0              10.75       0.75     0.0       0.0       90.0      0.0
9533                                                 POWER SUPPLY 1400 RIGHT SIDE
      -1      1      1    2      50.0      0.0       4.1875    0.0       11.
       0              10.75       7.75     0.0       0.0       0.0       90.
9633                                                 POWER SUPPLY 1400 LEFT SIDE
       1      1      1    2      50.0      0.0       4.1875    0.0       11.0
       0              10.75       0.75     0.0       0.0       0.0       90.
 133                                                 CASING TOP
      -1      1      1    7      60.0      0.0       28.5      0.0       22.
       0               0.0        0.0      6.5       0.0       0.0       0.0
 233                                                 CASING FRONT
       1      1      1   14      30.0      0.0       28.5      0.0       6.5
       0              22.0        0.0      0.0       0.0       90.0      0.0
 333                                                 CASING BACK
      -1      1      1   14      30.0      0.0       28.5      0.0       6.5
```

```
         0          0.0       0.0       0.0        0.0       90.0       0.0
    433                                            CASING RIGHT SIDE
         1     1     1    6   220.0     0.0        6.5       0.0        22.
         0          0.0       23.5      0.0        0.0       0.0        90.
    533                                            CASING LEFT SIDE
        -1     1     1    3   110.0     0.0        6.5       0.0        22.
         0          0.0       0.0       0.0        0.0       0.0        90.
    633                                            CASING BOTTOM
         1     1     1   14   110.0     0.0        28.5      0.0        22.
         0          0.0       0.0       0.0        0.0       0.0        0.0
  -1
30.0        -30.0         0.0
L BAND TRANSMITTER

30.0        -30.0         0.0
BENNETT
0.0          0.0          0.0
L BAND TRANSMITTER

0.0          0.0          0.0
BENNETT
0.0         -90.0         0.0
L BAND TRANSMITTER

0.0         -90.0         0.0
BENNETT
END
/ FOSYS FT18F001,TYPE=PLOT
/ EOJ
```

Appendix C

COLAPS

```
/ JOB BENNETT,77G12634,BENNT2,OPT=(C,R),CAT=22
/ LIMIT MIN=15,BAND=150
/ FD MY,USERCAT/D77/B20/BENNT2
/ FD FT14F001,BAND=5/20/5
/ FD FT07F001,BAND=5/20/5
/ FD FT06F001,BAND=5/20/5
/ ASG LCOLAPS,MY/COLAPS/LCOLAPS,USE=SHR
/ EXQT GO=LCOLAPS,CPTIME=400000,OPT=(Z,A)
 L BAND 1 TRANSMITTER COLAPS 2 DATA
   32     0     5

    1    1
    2    2
    3    3
    4    4
    5    5    6
    6    7    8
    7    9
    8   10
    9   11
   10   12
   11   13
   12   14
   13   15
   14   16
   15   17
   16   18
   17   19
   18   20
   19   21
   20   22
   21   23
   22   24
   23   25
   24   26
   25   27
   26   28
   27   29
   28   30
   29   31
   30   32
    0
 L BAND 1 TRANSMITTER COLAPS DATA
0.1280E 030.5950E 010.5259E-010.6602E-010.0000E 000.2032E 000.0000E 000.6297E-01
0.1130E 020.2654E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 00
0.1909E-010.6011E 000.6819E-010.3242E-010.1782E-010.8574E 000.1652E 000.8079E-01
0.4601E-010.0000E 000.5914E 010.7865E 010.2200E 000.1489E 020.3864E 000.2466E 02
0.2922E 020.1414E-010.8563E-020.0000E 000.1966E-010.0000E 000.5295E-020.9430E 00
0.2301E-010.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.1044E 00
0.5769E 000.6387E-020.2031E-020.9917E-030.6874E 000.1497E 000.5182E-010.1465E-01
0.0000E 000.6726E 010.1236E 020.2294E 000.2781E 010.7081E-010.0000E 00
0.2922E 020.2244E 000.1013E-020.1750E 000.7095E-020.2235E 000.5829E-010.4708E 01
0.5619E-010.8390E-020.1211E-010.1526E-010.8604E-020.2006E-010.2630E-010.3113E-01
0.6710E-010.1744E 000.6365E 000.1692E-010.3991E-010.1193E 000.9496E 000.9334E-02
0.8685E 010.2260E 010.1739E 000.2742E 010.7545E 010.1392E 00
0.3366E 020.1391E-010.7232E-010.1863E 000.1415E 010.3822E-010.6065E 010.2587E-01
0.3432E-020.8699E-020.1717E-010.5851E-020.1645E-010.5871E-010.3123E-010.7546E-01
0.2104E 000.7444E 000.7367E-010.1232E 000.1999E 000.3293E 000.1209E 000.1018E 02
0.6000E 000.8930E 000.2785E 000.1137E 020.2100E 00
0.7070E 010.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 00
0.0000E 000.0000E 000.0000E 000.0000E 000.7451E-020.0000E 000.0000E 000.0000E 00
0.0000E 000.7105E-020.7174E-020.7097E-020.7054E-020.0000E 000.6756E 010.0000E 00
0.1161E 000.1695E-010.1389E 000.2103E-01
0.4476E 020.0000E 000.9108E 010.2944E 000.5570E 000.3522E 000.4880E-010.1410E 00
```

```
0.2233E 000.1138E 000.1951E 000.4316E 000.2670E 000.9054E 000.2387E 010.1126E 01
0.2834E 000.3923E 000.4394E 000.3885E 000.0000E 000.8542E 010.1504E 020.6340E 00
0.6676E 000.6753E 000.7419E 00
0.7070E 010.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.0000E 00
0.0000E 000.0000E 000.4206E-020.0000E 000.0000E 000.0000E 000.0000E 000.0000E 00
0.5080E-020.7042E-020.6998E-020.0000E 000.6499E 010.0000E 000.1131E 000.1081E-01
0.2198E 000.1043E-01
0.4476E 020.8753E-020.4411E 010.2290E-020.1275E-020.9904E-020.4628E-020.0000E 00
0.0000E 000.0000E 000.3115E-010.1189E 000.7531E 000.2373E 010.1818E 000.2727E 00
0.3714E 000.4302E 000.0000E 000.5579E 010.1279E 020.0000E 000.5511E 000.5771E 01
0.1982E 00
0.1084E 030.3070E 000.1713E 020.0000E 000.0000E 000.0000E 000.0000E 000.0000E 00
0.6581E 000.1240E 010.1155E 000.4755E-010.2519E-010.8596E 000.5372E 000.2798E 00
0.1521E 000.0000E 000.2200E 020.2789E 020.1540E 010.2757E 010.4132E 000.1971E 02
0.1350E 030.1601E 000.4914E-010.6435E-010.6347E-010.2587E-010.6333E-010.0000E 00
0.2050E-010.5878E-010.1701E 000.4195E 010.2255E 000.4009E 000.7516E 000.3258E 01
0.0000E 000.1842E 020.3829E 020.6583E-010.9745E 010.4182E 020.7603E 00
0.2200E 030.3021E 020.5754E 010.7939E 010.2335E 010.1992E 020.7310E 000.2046E 00
0.1322E 000.7950E-010.3239E-010.1940E 000.2142E 000.1513E 000.1429E 000.2004E-01
0.1928E 020.4984E 020.3439E 020.1302E 010.3976E 000.1091E 02
0.6050E 020.2134E 020.0000E 000.0000E 000.0000E 000.2062E 000.8170E-010.2820E-01
0.1649E-010.1066E-010.0000E 000.3028E-010.4193E-010.2560E-010.5789E-020.2726E 01
0.1447E 010.3722E 000.8531E-020.8450E-010.3757E 01
0.6050E 020.2313E 020.0000E 000.0000E 000.5772E 000.7824E-010.4386E-010.2387E-01
0.1335E-010.0000E 000.0000E 000.6521E-010.4167E-010.3576E-020.3493E 010.1641E 01
0.3134E 000.1446E-010.1040E 000.3627E 01
0.6050E 020.2148E 020.0000E 000.1145E 010.7737E-010.5238E-010.2791E-010.1580E-01
0.0000E 000.0000E 000.7517E-010.4981E-010.5414E-020.2013E 010.2097E 010.3046E 00
0.4551E-010.1114E 000.1613E 01
0.6050E 020.2494E 020.5156E 000.1782E-010.2769E-010.1713E-010.3821E-020.0000E 00
0.0000E 000.1843E-010.2809E-010.1815E-020.2385E 010.9902E 000.1298E 000.2643E-01
0.5097E-010.7377E 01
0.6050E 020.6478E 000.3556E-010.6343E-010.4321E-010.9601E-020.0000E 000.0000E 00
0.4634E-010.7062E-010.6471E-020.3389E 010.1376E 010.2769E 010.6632E-010.1196E 00
0.6209E 01
0.7150E 020.3536E 000.3037E 000.1558E 000.3267E-020.3944E 000.3746E 000.3238E 00
0.2023E 000.1235E 000.1564E 020.1317E 020.3404E 020.9230E 000.2511E 000.1136E 00
0.4687E 020.0000E 000.0000E 000.0000E 000.1345E 010.7260E 000.2135E 000.7041E-01
0.0000E 000.1505E 020.2279E 020.7070E 000.1509E 010.1165E 000.6983E 00
0.4062E 020.0000E 000.0000E 000.7373E 000.1398E 010.7366E 000.2162E 000.0000E 00
0.1419E 020.1998E 020.5546E 000.3513E 000.1362E 000.2096E 00
0.4062E 020.0000E 000.2189E 000.7475E 000.1389E 010.7351E 000.0000E 000.1331E 02
0.1911E 020.1812E 000.2706E 000.3907E 000.1317E 00
0.4687E 020.7340E-010.2231E 000.7413E 000.1377E 010.0000E 000.1249E 020.2106E 02
0.1913E-010.7846E 000.8022E 000.9016E-01
0.4687E 020.0000E 000.0000E 000.0000E 000.1111E-010.1036E 020.8931E 010.9901E 00
0.1699E 020.2721E 000.1173E 01
0.4062E 020.0000E 000.0000E 000.1495E-010.9640E 010.7341E 010.9120E 000.1625E 02
0.3797E 000.3096E 00
0.4062E 020.0000E 000.1349E-010.9463E 010.7201E 010.8490E 000.1625E 020.5380E 00
0.1939E 00
0.4687E 020.1746E-010.9768E 010.6071E 010.6421E 000.1812E 020.1654E 010.1309E 00
0.3047E 030.5809E 020.7700E 020.1161E 020.4969E-010.2479E 020.1069E 00
0.6050E 030.1705E 030.4974E 020.2873E 020.2355E 020.3190E 02
0.6050E 030.2280E 020.1753E 020.3608E 010.1046E 02
0.1787E 030.3091E 010.9711E 010.6199E 00
0.1787E 030.5202E 010.1463E 02
0.1430E 030.2298E 01
0.1430E 03
-99.0
/ CATV MY/L3AND1/COLAPS/COLOUT,ACNM=FT07F001
/ FOSYS FT07F001
/ EOJ
```

Appendix D

SCRIPT f

```
/ JOB BENNETT,77G12684,BENNT2,OPT=(C,R),CAT=17
/ LIMIT MIN=9,BAND=150
/ PD MY,USERCAT/D77/32C/BENNT2
/ FD FT07F001,BAND=5/20/5
/ FD FT06F001,BAND=5/20/5
/ ASG LSCRPTF,MY/SCRIPTF/LSCRPTF,USE=SHR
/ FXQT GO=LSCRPTF
STRT
 L BAND 2 TRANSMITTER SCRIPT F DATA
   30  465
0.9        0.9        0.9        0.9        0.9        0.9        0.9        0.9
0.9        0.9        0.9        0.9        0.9        0.9        0.9        0.9
0.9        0.9        0.9        0.9        0.9        0.9        0.9        0.9
0.9        0.9        0.9        0.9        0.9        0.9        0.9        0.9
0
0
0
0
0.1280E 030.8414E-010.1975E-010.0000E 000.1279E 020.9763E 010.2097E 010.0000E 00
0.6857E 010.0000E 000.0000E 000.0000E 000.0000E 000.0000E 000.5551E 010.3745E 00
0.4519E-010.3755E-020.1859E-020.4127E 000.1910E 000.9640E-010.5818E-010.0000E 00
0.7936E 010.1442E 020.1953E 000.2765E 020.5693E-010.4021E 02
0.2922E 020.3576E-010.2094E-010.0000E 000.1347E 000.1139E 000.0000E 000.1461E 01
0.8902E-010.2045E 000.6491E 000.3795E 000.7307E 000.0000E 000.7867E 000.4436E-01
0.1236E-010.5866E-020.1299E 010.1496E 000.4954E-010.1996E-010.0000E 000.5701E 01
0.1100E 020.5329E 010.1464E 000.2024E 000.5726E 00
0.2922E 020.2272E 000.0000E 000.3025E-020.2843E 000.3949E 000.7217E-010.1325E-01
0.9709E-020.6494E-020.1512E-020.4787E-020.4651E-010.3495E-010.7816E-010.2149E 00
0.9699E 000.2215E-010.5433E-010.1607E 000.1016E 010.3060E-010.8567E 010.4612E 01
0.3563E 010.1673E 000.8436E 010.1740E 00
0.3366E 020.0000E 000.1344E-010.4039E 000.6546E 010.9404E-010.6985E-020.2503E-01
0.2871E-010.1782E-010.4379E-010.2161E-010.4914E-010.1153E 000.2583E 000.7544E 00
0.7853E-010.1300E 000.2074E 000.3186E 000.1058E 000.9407E 010.2423E 010.4869E 00
0.9317E 000.1093E 020.1111E 00
0.5183E 020.3738E 010.2944E 010.0000E 000.4491E 000.0000E 000.0000E 000.0000E 00
0.0000E 000.0000E 000.1703E 000.9811E-010.8924E-030.0000E 000.0000E 000.7665E-01
0.6642E-010.0000E 000.0000E 000.0000E 000.9907E 010.1171E 020.1675E-010.8958E 01
0.1282E-010.8692E 00
0.5183E 020.3621E 010.6499E-010.2652E 010.0000E 000.0000E 000.0000E 000.0000E 00
0.0000E 000.1318E 010.6932E 000.5410E-010.6217E-020.0000E 000.3452E 000.2109E 00
0.1385E 000.6361E-010.0000E 000.1239E 020.1430E 020.6330E 000.1252E 010.7543E-01
0.1360E 01
0.1090E 030.1750E 010.1072E 010.2017E 000.3155E 000.3370E 000.2016E 000.3736E 00
0.5304E 000.3351E 010.6050E 010.3395E 010.9527E 000.1135E 010.1383E 010.1184E 01
0.6373E 000.0000E 000.3063E 020.3638E 020.2462E 010.4212E 010.2103E 010.6763E 00
0.1350E 030.1712E 000.1576E-010.3752E-010.7086E-010.5293E-010.9950E-010.0000E 00
0.2083E-010.1534E 000.4770E 000.1885E 010.2675E 000.4663E 000.6189E 000.7592E 00
0.0000E 000.2212E 020.3825E 020.8273E 000.1493E 020.4492E 020.1168E 00
0.2200E 030.3246E 020.7006E 010.8667E 010.2849E 010.2193E 020.6681E 010.9169E 00
0.1533E 000.7357E-010.3638E-010.7905E 000.2940E 000.1189E 000.8081E-010.9940E-01
0.2165E 020.5298E 020.3907E 020.2286E 010.6680E 000.9361E 01
0.6050E 020.2058E 020.0000E 000.0000E 000.0000E 000.0000E 000.1962E 000.1931E-01
0.7986E-020.3741E-020.2473E 000.1004E 000.5508E-010.3576E-010.1349E-010.2268E 01
0.8061E 000.0000E 000.3322E-010.1040E 000.3242E 01
0.6050E 020.2329E 020.0000E 000.0000E 000.0000E 000.2027E 000.1738E-010.6676E-02
0.3291E-020.3863E 000.1054E 000.5679E-010.3045E-010.1739E-010.3308E 010.1084E 01
0.0000E 000.3585E-010.1280E 000.3653E 01
0.6050E 020.2133E 020.0000E 000.0000E 000.2414E 000.2474E-010.1092E-010.4588E-02
0.5860E 000.1378E 000.6912E-010.3135E-010.1607E-010.1715E 010.7451E 000.9236E 00
0.3241E-010.1569E 000.1435E 01
0.6050E 020.2462E 020.0000E 000.1692E 000.2048E-010.8666E-020.4293E-020.2765E 00
0.4579E-010.1771E-010.8371E-020.7155E-020.2263E 010.3716E 000.4675E 000.1098E-01
0.8362E-010.7308E 01
0.6050E 020.0000E 000.3251E 000.5935E-010.2787E-010.1304E-010.2764E 000.1525E-01
```

```
0.6007E-020.2556E-020.1306E-010.2899E 010.5903E 000.2661E 010.2492E-010.1938E 00
0.5594E 01
0.5275E 020.3213E 000.1107E 000.5311E-010.2606E-010.0000E 000.4046E-010.6488E-01
0.4632E-010.6736E-010.8875E 010.4854E 010.5639E-010.1078E 010.4489E 000.2239E 02
0.4687E 020.0000E 000.0000E 000.0000E 000.1587E 010.8700E 000.2404E 000.7787E-01
0.0000E 000.1315E 020.2034E 020.1731E 010.2829E 000.1652E 000.5489E 00
0.4062E 020.0000E 000.0000E 000.8587E 000.1840E 010.9117E 000.2447E 000.0000E 00
0.1199E 020.1696E 020.3799E 000.2813E-020.3365E 000.1520E 00
0.4062E 020.0000E 000.2366E 000.9158E 000.1893E 010.9207E 000.0000E 000.1276E 02
0.1812E 020.3796E 000.4314E-020.7491E 000.8507E-01
0.4687E 020.7555E-010.2430E 000.9023E 000.1820E 010.0000E 000.1299E 020.2049E 02
0.1641E 010.1817E 000.3905E 010.6427E-01
0.4687E 020.0000E 000.0000E 000.0000E 000.4163E-010.9585E 010.6370E 010.2042E 02
0.7896E 000.3874E 000.2235E 00
0.4062E 020.0000E 000.0000E 000.5095E-010.9249E 010.6091E 010.1660E 020.5456E 00
0.6103E 000.2124E 00
0.4062E 020.0000E 000.5406E-010.9245E 010.6239E 010.1662E 020.5888E 000.9222E 00
0.1555E 00
0.4687E 020.4878E-010.9517E 010.7622E 010.1936E 020.7131E 000.3104E 010.1309E 00
0.3047E 030.1345E 030.1477E 030.1775E 000.1931E 020.1988E 010.3874E 00
0.6050E 030.1112E 030.2066E 020.5067E 020.2695E 020.2286E 02
0.6050E 030.1176E 020.1808E 020.1509E 020.4386E 01
0.1787E 030.2512E 010.1069E 020.8200E-01
0.1787E 030.8116E 010.1497E 02
0.1430E 030.1670E 01
0.1430E 03
END
/ CATV MY/LBAND2/SCRIPTF,ACNM=FT07F001
/ FOSYS FT07F001
/ EOJ
```

Appendix E

SINDA

```

BCD 3THERMAL LPCS
BCD 9 L-BAND TRANSMITTER
BCD 3 HOT STUDY
END
BCD 3NODE DATA
     1,120.,0.689             $ RF POWER FILTER (BTU/R)
     2,120.,0.325             $ COAXIAL SWITCH 1
     3,120.,0.354             $ COAXIAL SWITCH 2
     4,120.,0.376             $ CIRCULATOR
     5,120.,0.195             $ CAPACITOR 1
     6,120.,0.195             $ CAPACITOR 2
     7,120.,0.466             $ SERIES 1100 POWER SUPPLY
     8,120.,0.410             $ FILTER
     9,120.,0.512             $ CARD BUCKET
     10,120.,0.051            $ CARD 1
     11,120.,0.051            $ CARD 2
     12,120.,0.051            $ CARD 3
     13,120.,0.051            $ CARD 4
     14,120.,0.051            $ CARD 5
     15,120.,0.051            $ CARD 6
     16,120.,0.051            $ CARD 7
     17,120.,0.258            $ AMP 1 #1
     18,120.,0.277            $ AMP 1 #2
     19,120.,0.277            $ AMP 1 #3
     20,120.,0.306            $ AMP 1 #4
     21,120.,0.258            $ AMP 2 #1
     22,120.,0.277            $ AMP 2 #2
     23,120.,0.277            $ AMP 2 #3
     24,120.,0.306            $ AMP 2 #4
     25,120.,1.628            $ 1400 SERIES POWER SUPPLY
     26,120.,7.938            $ CASING TOP
     27,120.,7.938            $ CASING BOTTOM
     28,120.,1.968            $ CASING FRONT
     29,120.,1.968            $ CASING BACK
     30,120.,1.519            $ CASING RIGHT SIDE
     31,120.,1.519            $ CASING LEFT SIDE
     32,120.,0.051            $ AIR INSIDE THE CASING
     33,120.,19.887           $ HEAT SINK PLATE
     -34,112.,1.0             $ TOP BOUNDARY
     -35,112.,1.0             $ BOTTOM BOUNDARY
     -36,112.,1.0             $ FRONT BOUNDARY
     -37,112.,1.0             $ BACK BOUNDARY
     -38,112.,1.0             $ RIGHT SIDE BOUNDARY
     -39,112.,1.0             $ LEFT SIDE BOUNDARY
END
BCD 3CONDUCTOR DATA
     1,1,31,169.245           $ RF FILTER TO LEFT SIDE
     2,1,32,0.200             $                  AIR
     -3,1,2,1.714E-11         $                  COAXIAL SWITCH 1
     -4,1,25,5.142E-11        $                  1400 POWER SUPPLY
     -5,1,26,2.057E-10        $                  CASING TOP
     -6,1,27,2.057E-10        $                  CASING BOTTOM
     -7,1,29,1.200E-10        $                  CASING BACK
     -8,1,31,2.228E-10        $                  CASING LEFT SIDE
     9,2,27,51.414            $ COAXIAL SWITCH 1 TO CASING BOTTOM
     10,2,32,0.038            $                     AIR
     -11,2,26,6.856E-11       $                     CASING TOP
     -12,2,27,1.200E-10       $                     CASING BOTTOM
     -13,2,29,6.856E-11       $                     CASING BACK
     -14,2,31,1.714E-11       $                     LEFT SIDE
```

```
6200      15,3,30,4,166          $ COAXIAL SWITCH 2 TO CASING BOTTOM
6300      16,3,32,0.038          $                              AIR
6400      -17,3,8,5.142E-11      $                              FILTER
6500      -18,3,26,8.570E-11     $                              CASING TOP
6600      -19,3,27,1.714E-11     $                              CASING BOTTOM
6700      -20,3,29,3.428E-11     $                              CASING BACK
6800      -21,3,30,6.856E-11     $                              RIGHT SIDE
6900      22,4,30,3.954          $ CIRCULATOR TO CASING RIGHT SIDE
7000      23,4,32,0.074          $                       AIR
7100      -24,4,8,5.142E-11      $                       FILTER
7200      -25,4,9,1.714E-11      $                       CARD BUCKET
7300      -26,4,26,1.028E-10     $                       CASING TOP
7400      -27,4,27,3.428E-11     $                       CASING BOTTOM
7500      -28,4,29,1.714E-11     $                       CASING BACK
7600      -29,4,30,1.028E-10     $                       CASING RIGHT SIDE
7700      30,5,27,5.923          $ CAPACITOR 1 TO CASING BOTTOM
7800      31,5,32,0.129          $                         AIR
7900      -32,5,6,5.142E-11      $                         CAPACITOR 2
8000      -33,5,7,6.856E-11      $                         1100 SERIES POWER
8100      -34,5,9,6.856E-11      $                         CARD BUCKET
8200      -35,5,25,1.714E-11     $                         1400 SERIES POWER
8300      -36,5,26,1.371E-10     $                         CASING TOP
8400      -37,5,27,1.200E-10     $                         CASING BOTTOM
8500      -38,5,28,1.714E-11     $                         CASING FRONT
8600      -39,5,29,1.714E-11     $                         CASING BACK
8700      -40,5,30,1.714E-11     $                         CASING RIGHT SIDE
8800      41,6,27,5.923          $ CAPACITOR 2 TO CASING BOTTOM
8900      42,6,32,0.129          $                         AIR
9000      -43,6,7,8.570E-11      $                         1100 SERIES POWER
9100      -44,6,9,1.200E-10      $                         CARD BUCKET
9200      -45,6,26,6.856E-11     $                         CASING TOP
9300      -46,6,27,8.570E-11     $                         CASING BOTTOM
9400      -47,6,28,1.371E-10     $                         CASING FRONT
9500      48,7,27,70.205         $ 1100 SERIES POWER TO CASING BOTTOM
9600      49,7,32,0.234          $                              AIR
9700      -51,7,9,1.714E-11      $                              CARD BUCKET
9800      -52,7,17,1.714E-11     $                              AMP 1 #1
9900      -53,7,25,2.228E-10     $                              1400 SFIRES
10000     -54,7,26,2.571E-10     $                              CASING TOP
10100     -55,7,27,2.228E-11     $                              CASING BOTTOM
10200     -56,7,28,2.057E-10     $                              CASING FRONT
10300     -57,7,29,1.714E-11     $                              CASING BACK
10400     58,8,27,478.735        $ FILTER TO CASING BOTTOM
10500     61,8,32,0.180          $                AIR
10600     -62,8,9,1.714E-11      $                CARD BUCKET
10700     -63,8,20,3.428E-11     $                AMP 1 #4
10800     -64,8,24,3.428E-11     $                AMP 2 #4
10900     -65,8,25,1.714E-11     $                1400 SERIES POWER SUPPLY
11000     -66,8,26,2.228E-11     $                CASING TOP
11100     -67,8,27,4.114E-10     $                CASING BOTTOM
11200     -68,8,29,1.371E-10     $                CASING BACK
11300     -69,8,30,3.942E-10     $                CASING RIGHT SIDE
11400     -70,8,31,1.714E-11     $                CASING LEFT SIDE
11500     71,9,27,1.810          $ CARD BUCKET TO BOTTOM
11600     72,9,32,0.257          $                         AIR
11700     -73,9,10,2.400E-10     $                         CARD 1
11800     -74,9,11,5.142E-11     $                         CARD 2
11900     -75,9,12,8.570E-11     $                         CARD 3
12000     -76,9,13,8.570E-11     $                         CARD 4
12100     -77,9,14,5.142E-11     $                         CARD 5
12200     -78,9,15,5.142E-11     $                         CARD 6
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-79,9,16,2.914E-10       $                    CARD 7
-80,9,25,1.714E-11       $                    1400 SERIES POWER
-81,9,26,2.914E-10       $                    CASING TOP
-82,9,27,6.856E-10       $                    CASING BOTTOM
-83,9,28,2.057E-10       $                    CASING FRONT
-84,9,29,1.714E-11       $                    CASING BACK
-85,9,30,3.428E-10       $                    CASING RIGHT SIDE
-86,9,31,1.714E-11       $                    CASING LEFT SIDE
87,10,9,2.183            $ CARD 1 TO CARD BUCKET
88,10,32,0.229           $           AIR
-89,10,11,2.057E-10      $           CARD 2
-90,10,26,1.714E-11      $           CASING TOP
-91,10,27,1.714E-11      $           CASING BOTTOM
-92,10,28,1.028E-10      $           CASING FRONT
93,11,9,2.183            $ CARD 2 TO CARD BUCKET
94,11,32,0.229           $           AIR
-95,11,12,2.228E-10      $           CARD 3
-96,11,26,5.142E-11      $           CASING TOP
-97,11,27,1.714E-11      $           CASING BOTTOM
-98,11,28,3.428E-11      $           CASING FRONT
99,12,9,2.183            $ CARD 3 TO CARD BUCKET
100,12,32,0.229          $           AIR
-101,12,13,1.865E-10     $           CARD 4
-102,12,26,5.142E-11     $           CASING TOP
-103,12,27,1.714E-11     $           CASING BOTTOM
-105,12,28,1.714E-11     $           CASING FRONT
107,13,9,2.183           $ CARD 4 TO CARD BUCKET
108,13,32,0.229          $           AIR
-109,13,14,1.885E-10     $           CARD 5
-110,13,26,1.714E-11     $           CASING TOP
-111,13,27,1.714E-11     $           CASING BOTTOM
-112,13,28,1.028E-10     $           CASING FRONT
113,14,9,2.183           $ CARD 5 TO CARD BUCKET
114,14,32,0.229          $           AIR
-115,14,15,1.865E-10     $           CARD 6
-116,14,26,3.428E-11     $           CASING TOP
-117,14,27,1.714E-11     $           CASING BOTTOM
-118,14,28,6.856E-11     $           CASING FRONT
119,15,9,2.183           $ CARD 6 TO CARD BUCKET
120,15,32,0.229          $           AIR
-121,15,16,2.057E-10     $           CARD 7
-122,15,26,3.428E-11     $           CASING TOP
-123,15,27,1.714E-11     $           CASING BOTTOM
-124,15,28,1.714E-11     $           CASING FRONT
-125,15,30,1.714E-11     $           CASING RIGHT SIDE
126,16,9,2.183           $ CARD 7 TO CARD BUCKET
127,16,32,0.229          $           AIR
-128,16,26,3.428E-11     $           CASING TOP
-129,16,27,1.714E-11     $           CASING BOTTOM
-130,16,28,1.714E-11     $           CASING FRONT
-131,16,30,1.714E-11     $           CASING RIGHT SIDE
132,17,18,21.260         $ AMP 1 #1 TO AMP 1 #2
133,17,27,0.864          $              CASING BOTTOM
134,17,32,0.081          $              AIR
-135,17,21,1.714E-11     $              AMP 2 #2
-136,17,25,3.428E-11     $              1400 SERIES POWER SUP.
-137,17,26,1.543E-11     $              CASING TOP
-138,17,27,2.228E-10     $              CASING BOTTOM
-139,17,29,1.714E-11     $              CASING BACK
-140,17,31,1.714E-11     $              CASING LEFT SIDE
141,18,19,21.260         $ AMP 1 #2 TO AMP 1 #3
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18400     142,18,27,3.456           $                 CASING BOTTOM
18500     143,18,32,0.089           $                 AIR
18600     -144,18,22,1.714E-11      $                 AMP 2 #2
18700     -145,18,26,1.543E-10      $                 CASING TOP
18800     -146,18,27,1.885E-10      $                 CASING BOTTOM
18900     -147,18,29,1.714E-11      $                 CASING BACK
19000     148,19,20,21.260          $ AMP 1 #3 TO AMP 1 #4
19100     149,19,27,3.456           $                 CASING BOTTOM
19200     150,19,32,0.089           $                 AIR
19300     -151,19,23,1.714E-11      $                 AMP 2 #3
19400     -152,19,26,1.543E-10      $                 CASING TOP
19500     -153,19,27,1.885E-11      $                 CASING BOTTOM
19600     -154,19,29,1.714E-11      $                 CASING BACK
19700     155,20,27,3.456           $ AMP 1 #4 TO CASING BOTTOM
19800     156,20,32,0.094           $                 AIR
19900     -157,20,24,1.714E-11      $                 AMP 2 #4
20000     -158,20,26,1.543E-10      $                 CASING TOP
20100     -159,20,27,2.057E-10      $                 CASING BOTTOM
20200     -160,20,29,1.714E-11      $                 CASING BACK
20300     -161,20,30,1.714E-11      $                 CASING RIGHT SIDE
20400     162,21,22,21.260          $ AMP 2 #1 TO AMP 2 #2
20500     163,21,27,0.864           $                 CASING BOTTOM
20600     164,21,32,0.081           $                 AIR
20700     -165,21,25,1.714E-11      $                 1400 SERIES POWER SUP.
20800     -166,21,26,1.371E-10      $                 CASING TOP
20900     -167,21,27,2.057E-10      $                 CASING BOTTOM
21000     -168,21,29,8.570E-11      $                 CASING BACK
21100     -169,21,31,1.714E-11      $                 CASING LEFT SIDE
21200     170,22,23,21.260          $ AMP 2 #2 TO AMP 2 #3
21300     171,22,27,3.456           $                 CASING BOTTOM
21400     172,22,32,0.089           $                 AIR
21500     -173,22,26,1.371E-10      $                 CASING TOP
21600     -174,22,27,1.714E-10      $                 CASING BOTTOM
21700     -175,22,29,6.856E-11      $                 CASING BACK
21800     176,23,24,21.260          $ AMP 2 #3 TO AMP 2 #4
21900     177,23,27,3.456           $                 CASING BOTTOM
22000     178,23,32,0.089           $                 AIR
22100     -179,23,26,1.371E-10      $                 CASING TOP
22200     -180,23,27,1.714E-10      $                 CASING BOTTOM
22300     -181,23,29,6.856E-11      $                 CASING BACK
22400     182,24,27,3.456           $ AMP 2 #4 TO CASING BOTTOM
22500     183,24,32,0.094           $                 AIR
22600     -184,24,26,1.371E-10      $                 CASING TOP
22700     -185,24,27,1.885E-10      $                 CASING BOTTOM
22800     -186,24,29,8.570E-11      $                 CASING BACK
22900     -187,24,30,1.714E-11      $                 CASING RIGHT SIDE
23000     188,25,27,386.130         $ 1400 SERIES POWER TO CASING BOTTOM
23100     189,25,32,0.697           $                           AIR
23200     -190,25,26,8.056E-10      $                           CASING TOP
23300     -191,25,27,9.770E-10      $                           CASING BOTTOM
23400     -192,25,28,3.771E-10      $                           CASING FRONT
23500     -193,25,29,6.856E-11      $                           CASING BACK
23600     -194,25,30,1.714E-11      $                           RIGHT SIDE
23700     -195,25,31,5.485E-10      $                           LEFT SIDE
23800     196,26,28,4.435           $ CASING TOP TO CASING FRONT
23900     197,26,29,4.435           $                   CASING BACK
24000     198,26,30,3.423           $                   CASING RIGHT SIDE
24100     199,26,31,3.423           $                   CASING LEFT SIDE
24200     200,26,32,2.003           $                   AIR
24300     -201,26,27,1.371E-09      $                   CASING BOTTOM
24400     -202,26,28,3.942E-10      $                   CASING FRONT
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                  -203,26,29,6.170E-10   $                 CASING BACK
                  -204,26,30,2.228E-10   $                 CASING RIGHT SIDE
                  -205,26,31,3.065E-10   $                 CASING LEFT SIDE
                  206,27,28,4.435        $ CASING BOTTOM  TO CASING FRONT
                  207,27,29,4.435        $                     CASING BACK
                  208,27,30,3.423        $                     CASING RIGHT SIDE
                  209,27,31,3.423        $                     CASING LEFT SIDE
                  210,27,32,1.001        $                     AIR
                  211,27,33,1000.        $                     HEAT-SINK PLATE
                  -212,27,28,8.570E-11   $                     CASING FRONT
                  -213,27,29,2.571E-10   $                     CASING BACK
                  -214,27,30,1.200E-10   $                     RIGHT SIDE
                  -215,27,31,1.543E-10   $                     LEFT SIDE
                  216,28,30,2.033        $ CASING FRONT TO RIGHT SIDE
                  217,28,31,2.033        $                   LEFT SIDE
                  218,28,32,0.395        $                   AIR
                  -219,28,29,5.142E-11   $                   CASING BACK
                  -220,28,30,1.714E-11   $                   RIGHT SIDF
                  -221,28,31,8.570E-11   $                   LEFT SIDE
                  222,29,30,2.033        $ CASING BACK TO RIGHT SIDE
                  223,29,31,2.033        $                  LEFT SIDE
                  224,29,32,0.434        $                  AIR
                  -225,29,30,6.856E-11   $                  RIGHT SIDE
                  -226,29,31,6.856E-11   $                  LEFT SIDE
                  227,30,32,0.149        $ CASING RIGHT SIDE TO AIR
                  -228,30,31,1.714E-11   $                        LEFT SIDE
                  229,31,32,0.263        $ CASING LEFT SIDE TO AIR
                  230,26,34,3.843        $ CASING TOP TO BOUNDARY
                  231,33,35,100.00       $ HEAT SINK TO BOUNDARY
                  232,28,36,0.953        $ CASING FRONT TO BOUNDARY
                  233,29,37,0.953        $ CASING BACK TO BOUNDARY
                  234,30,38,0.903        $ CASING RIGHT SIDE TO BOUNDARY
                  235,31,39,0.368        $ CASING LEFT SIDE TO BOUNDARY
                  236,33,34,0.971        $ HEAT SINK TO TOP BOUNDARY
              END
              BCD 3CONSTANTS DATA
                  TIMEO,0.0
                  DTIMEI,0.0083333
                  DRLXCA,0.25
                  ARLXCA,0.25
                  TIMEND,0.999996        $ 30 MINUTE CYCLE TIME
                  OUTPUT,0.083333        $ OUTPUT EVERY 5 MINUTES
                  NLOOP,500              $ MAXIMUM ITERATIONS
                  1,68.24                $ RF POWER FILTER (BTU/HR)
                  2,0.0                  $ COAXIAL SWITCH 1
                  3,0.0                  $ COAXIAL SWITCH 2
                  4,16.29                $ CIRCULATOR (BTU/HR)
                  5,0.0                  $ CAPACITOR 1
                  6,0.0                  $ CAPACITOR 2
                  7,61.42                $ 1100 SERIES POWER SUPPLY
                  8,20.47                $ FILTER
                  9,0.0                  $ CARD BUCKET
                  10,0.0                 $ CARD 1
                  11,85.30               $ CARD 2
                  12,85.30               $ CARD 3
                  13,85.30               $ CARD 4
                  14,85.30               $ CARD 5
                  15,0.0                 $ CARD 6
                  16,17.06               $ CARD 7
                  17,17.06               $ AMP 1 #1
                  18,34.12               $ AMP 1 #2
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                  19,170.60               $ AMP 1 #3
                  20,272.97               $ AMP 1 #4
                  21,17.06                $ AMP 2 #1
                  22,34.12                $ AMP 2 #2
                  23,170.60               $ AMP 2 #3
                  24,272.97               $ AMP 2 #4
                  25,759.53               $ 1400 SERIES POWER SUPPLY (BTU/HR)
                  26,0.0                  $ USED TO ZERO OUT HEAT SOURCES
              END
              BCD 3ARRAY DATA
                  1                                              $ TIME ARRAY
                  0.000,0.008,0.017,0.025,0.033,0.042,0.050,0.058,0.067,0.075
                  0.083,0.092,0.100,0.108,0.117,0.125,0.133,0.142,0.150,0.158
                  0.167,0.175,0.183,0.192,0.200,0.208,0.217,0.225,0.233,0.242
                  0.250,0.258,0.267,0.275,0.283,0.292,0.300,0.308,0.317,0.325
                  0.333,0.342,0.350,0.358,0.367,0.375,0.383,0.392,0.400,0.408
                  END   $ TIME IN HOURS BY 1/2 MINUTE INCREMENTS
              END
              BCD 3EXECUTION
F            DIMENSION X(2000)
F            NDIM=2000
F            NTH=0
F            DO 10 ICOU=1,5
                  FWDBCK
M            TIMEO=0.0
F10          CONTINUE
              END
              BCD 3VARIABLES 1
M            IF(TIMEM.GT.0.084.AND.TIMEM.LE.0.5)GO TO 10
M            IF(TIMEM.GT.0.583333)GO TO 10
                  SHFTV(25,K1,Q1)            ! SHIFT HEAT SOURCE INTO COMPONENTS
F            GO TO 20
F10          CONTINUE
                  ARYMPY(25,Q1,K26,Q1)        ! ZERO OUT HEAT SOURCES
                  SHFTV(1,K16,Q16)            ! A/D LOGIC CARD ALWAYS ON
F20          CONTINUE
              END
              BCD 3VARIABLES 2
              END
              BCD 3OUTPUT CALLS
                  TPRINT
              END
              BCD 3END OF DATA
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END

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